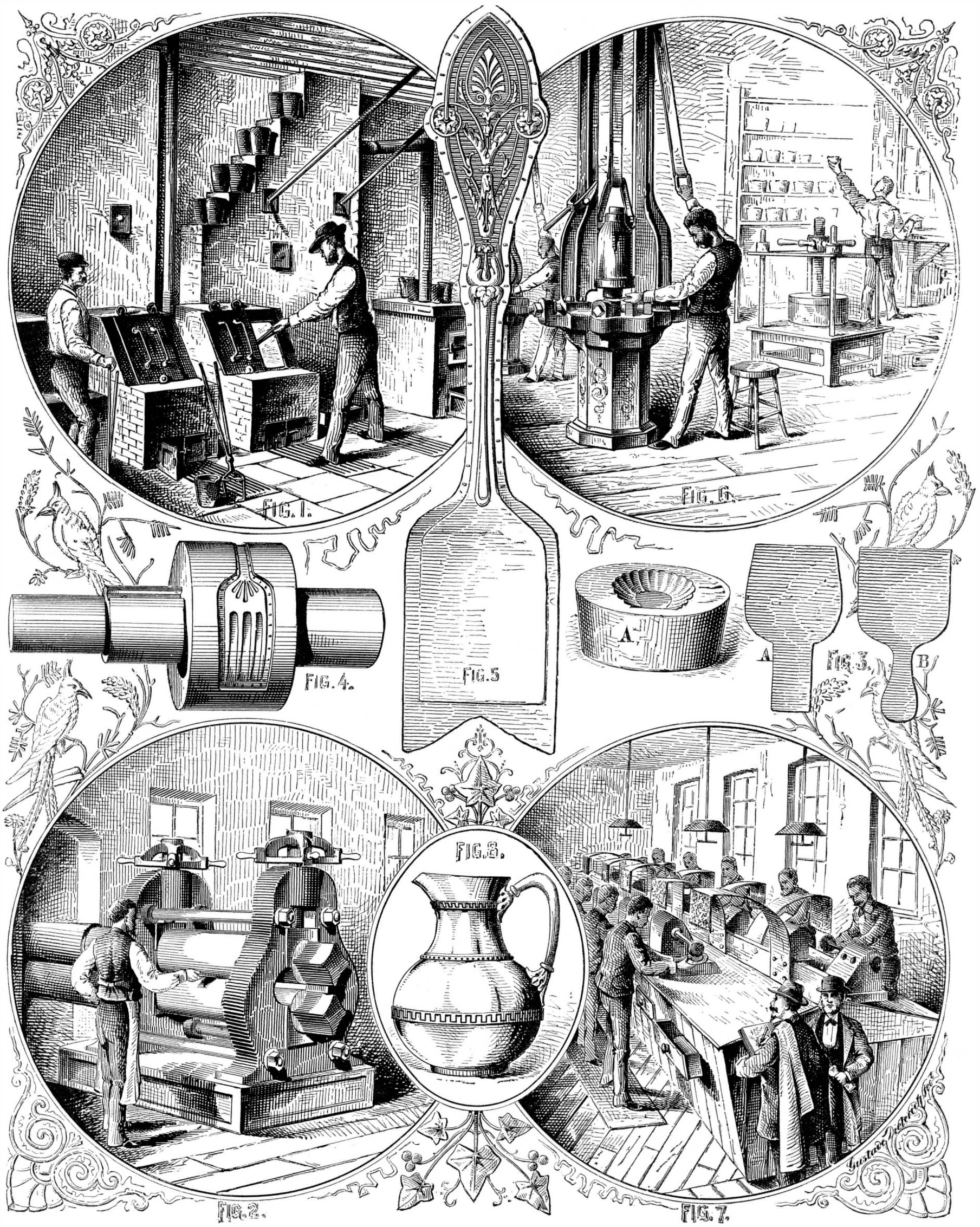
SCIENTIFIC AMERICAN

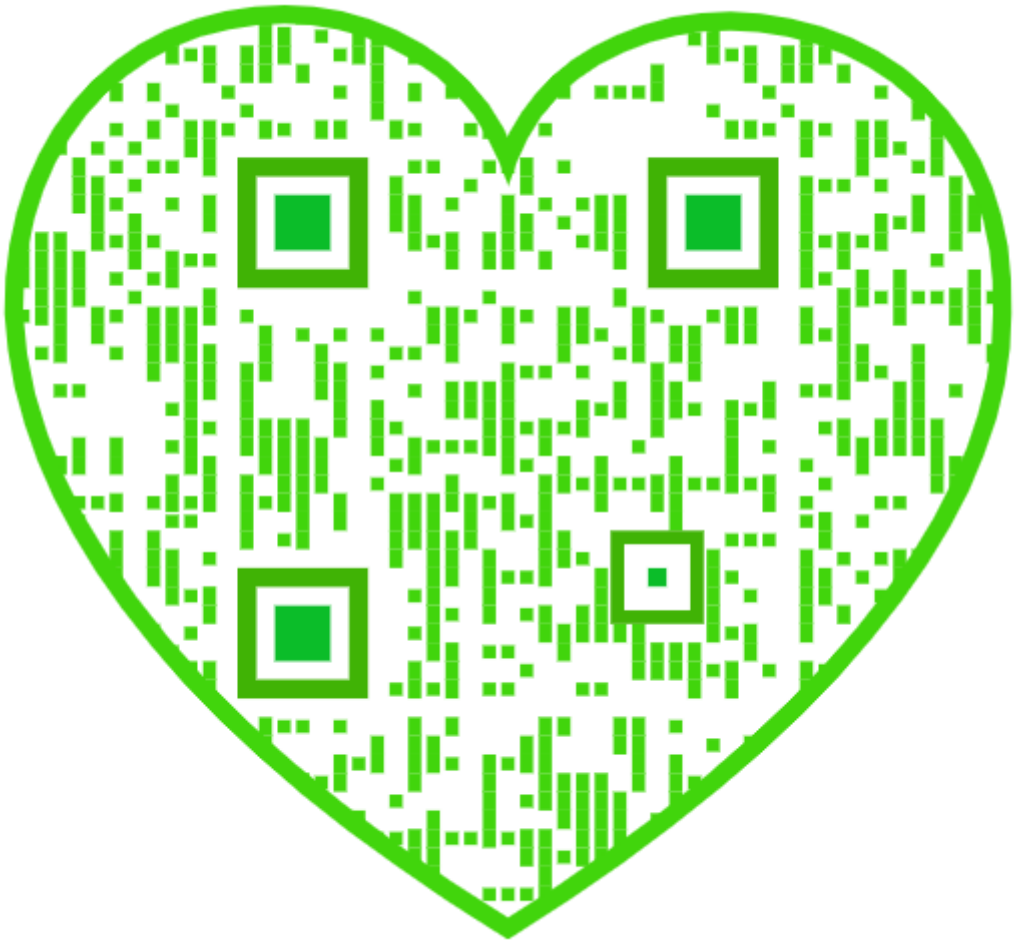
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI.—No. 19. [NEW SERIES.] NEW YORK, MAY 12, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF SILVERWARE.—(See page 290.)

© 1877 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included..... **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 19. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, MAY 12, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Answers to correspondents 299
Baby brutes*..... 295
Belts, friction of (33)..... 300
Bichromate of potash, antiseptic 296
Blast, a tremendous mining..... 291
Blowpipe reagents, new..... 295
Boilers, capacity of (4) 299, (34) ... 300
Boilers, leaks in (31)..... 300
Boilers, management of..... 298
Bridge, the Niagara railway..... 297
Bryant vase, the*..... 291
Business and personal..... 299
Calculating machine, new*..... 294
Canals, cleaning (5)..... 299
Centrifugal force, the (6)..... 299
Correspondence, our Washington 292
Dead, dangers from the..... 295
Driving horses by electricity..... 291
Dryers, paint (28)..... 300
Dyeing wood blue (15)..... 299
Education, self..... 289
Engineers, duties of..... 293
Explosions, remarkable..... 292
Fire escape, a simple..... 289
Fire escape, improved*..... 294
Flywheels, proportions of (32)..... 300
Friction of a planed surface (11) 299
Friction of a propeller (10)..... 299
Galvanizing iron (14)..... 299
Great Eastern, the (7)..... 299
Gun, the Krupp (2)..... 299
Iceland spar, new facts about..... 291
Inventions patented in England. 298
Inventive progress, American .. 292
Iron girders, strength of (1)..... 299
Labor-saving appliances..... 294
Lands below the ocean level..... 288
Launches, the Thorneycroft fast 288
Lions, young, in Central Park*.. 295
Lightning rods (21)..... 299
Locomotive engineer, the oldest 292
Lubricants (9)..... 299
Manipulation, curious*..... 296
Mississippi work, Captain Eads'.. 295
Nickel and cobalt plating..... 295
Oil and sawdust (20)..... 299
Panthers in Central Park*..... 295
Paper, transparent (16)..... 299
Patent decisions, recent..... 297
Patents, American and foreign.. 298
Patents, official list of..... 300
Petroleum, the origin of..... 294
Phosphorus lamp, the (12)..... 299
Photographs by telegraph..... 297
Polishing copper (18)..... 299
Powder for mining coal (26)..... 300
Practical mechanism—No. 25*.... 293
Propeller, slip of a (6)..... 299
Pyroligneous acid (19)..... 299
Railway ticket manufacture..... 297
Salicylic acid..... 294
Screw-cutting, remarkable*..... 296
Silverware, manufacture of* 287, 290
Speeds, high (35)..... 300
Spindles, welding (22, 23, 24, 25) 299, (37, 38, 39) 300
Star, temporary, what is a..... 289
Steam, pressure of (36)..... 300
Stream power and its utilization. 292
Sun and the fire, the (30)..... 300
Timber, decay of..... 298
Time, pneumatic transmission of 292
Torpedo, a fast..... 295
Vegetarianism, on..... 295
Washing hard-finished walls (27). 300
Water, tannic acid for testing... 296
Water works of Baltimore, the.. 288
Weight, distribution of (8)..... 299
Well, a wonderful spouting..... 291
Zinc, purifying..... 295

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 71,
For the Week ending May 12, 1877.

I. MECHANICS AND ENGINEERING.—Refrigerating Freight Cars.—New Passenger Station at Washington, D. C. Baltimore and Potomac Railroad, 1 engraving.—Iron Railway Cars in Belgium.—Furnace for the Combustion of Bituminous Coal without Smoke. By J. B. HOYT. 2 engravings.—Eight Horse Power Traction Engine, by Marshall & Co., 3 engravings.—Steel Making, Direct Process, Larkin's Method.—Iron as a Building Material. Its defects specially pointed out.—Tempering Spring and Tool Steel. Useful Directions.—Opening of the New Avonmouth Dock, Bristol, England, page engraving.—Building of a Remarkable Lighthouse, France.—New and Powerful Armstrong Gun.—A Cheap Farm Bridge; general description, dimensions, and particulars, with 2 pages of drawings, covering illustrations of all the details, for a bridge of 100 feet span or less; specially useful for crossing of creeks, small rivers, gullies, or wherever a costly structure is not desirable. The drawings are from the Spar Bridge exhibited at the Centennial, in the U. S. Department of Military Engineering.—Iron and Steel. By Dr. C. W. SIEMENS. A most interesting and valuable paper, containing accounts of the most recent practical improvements in the Production, Working, and Application of Iron and Steel; embracing the question of Labor in its relation to Capital; the Character, Value, Cost, and Production of the various kinds of Fuel, including Bituminous Coals, Coke, American Fuels, Peat, Natural Gas Fuel, Artificial Gas Fuel, Liquid Fuel, Solar Fuel. Motive Powers and their Tranmission over long distances. Water Power; its Transmission by Steel Ropes; its Transmission by Electricity. Wind Power. Bessemer Steel History. Siemens and Martin Steel. The Regenerative Furnace. The Open Hearth System. The Use of Ferro-Manganese. Use of Chromium. Production of Mild Steel. Piping of Steel. The Applications of Steel. Iron and Steel Nomenclature. Wrought Iron. Mechanical Puddling. Bell's New Process. Wrought Iron Direct from the ore. Methods of Protecting Iron and Steel from Rust. Ainslie's Method. Barff's Method.

II. ELECTRICITY, LIGHT, HEAT, ETC.—Stratification of the Electric Discharge in Vacuum Tubes.—Mance's method of determining Electric Intensity.—New method of determining the melting points of metals by electrical apparatus.—A New Mercury.—Bichromate Battery, effective and economical, with 2 illustrations.—Electrical Time Ball.—Electrical Conductivity in Liquids.—Rotary Magnetic Polarization.—Thermo Currents in an Electrolyte. Accidental or Subjective Colors.

III. CHEMISTRY, ETC.—The Adulteration of Milk. By HENRY A. MOTT, Jr., 4 illustrations.—Analysis and Composition of the Sweet Potato.—Atomic Weight of Selenium.
Moss Copper. By W. M. HUTCHINGS. Connection Currents.—The Photographic Image.—New Method of producing Nitrogen. By J. W. GATEHOUSE.—Increase of Weight by Combustion.—Meeting of the German Chemical Society, Berlin. Notices of a large number of papers by distinguished chemists. Meeting of the Chemical Society, London.—Zinc Copper Couples.—Chromium Pig Iron.—Estimation of Bismuth.

IV. MISCELLANEOUS.—Vibrations of Cylindrical Rods.—Manometers.—Exploring Balloons for Meteorological Purposes.—Radiometer.—What is Bathybius? The Eyes of a Flounder.—A Live Anaconda.—Separating of Cocoon Threads.—Cachou de Laval, the new patent color.

Terms:—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, *five dollars*. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, *seven dollars*. CLUBS.—One extra copy of the SUPPLEMENT will be supplied gratis for every club of five SUPPLEMENT subscribers at $5.00 each.

All the back numbers of the SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price 10 cents each.

NOW READY.—The SCIENTIFIC AMERICAN SUPPLEMENT for 1876. Complete in two large volumes. Over 800 quarto pages; over 2,000 engravings. Embracing History of the Centennial Exhibition. New Illustrated Instructions in Mechanical Drawing. Many valuable papers, etc. Price five dollars for the two volumes, stitched in paper; or six dollars and fifty cents, handsomely bound in stiff covers.

Remit by postal order. Address

MUNN & CO. PUBLISHERS,
37 Park Row, New York.

☞ Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 10 cents.

LANDS BELOW THE OCEAN LEVEL.

In an article treating on some remarkable results of evaporation and rainfall, published on page 257 of our issue of April 28, this year, we described one of the instances of the great excesses of evaporation over rainfall, namely, the Caspian Sea, on which the surface is as much below the ocean level as our Lake Champlain is above the same, namely, more than 80 feet. There are, however, two still more remarkable cases of the same sort, the Dead Sea in Palestine and the Great Desert or Sahara in Africa. The former is remarkable for the great amount of the depression, and the latter for the immense surface depressed, being in fact the bottom of an extensive inland lake, totally dried up by the heat of a tropical climate, aided by the absence of feeding streams, and by the rainless area which covers its greatest portion. It is, on an average, 80 feet below the ocean, about as much as the Caspian Sea; but it is remarkable for its extent, being nearly 2,000 miles square, or nearly 4,000,000 square miles.

The French government, having an eye to the colonization of Northern Africa, with Algiers as a starting point, has for some time favored a project for restoring this sandy waste to its primeval condition by cutting a communication with the ocean, and so transforming it into a salt water inland lake. The effect of this on the climate of the surrounding country, and especially on the colony of Algiers, would undoubtedly be most beneficial, because the south wind, instead of blowing, as it does now, over a sandy desert, would become a sea breeze; this would increase the rainfall, and change a rainless district into a fruitful region. In a commercial point of view, moreover, the benefits of such a change could not be overestimated. The introduction of water transportation is especially advisable in this tropical region, where the miserable and utterly inefficient caravan is now the only mode of carrying goods; and without doubt commercial cities would soon spring up around the shores of the proposed inland sea, which would become the scene of a mighty travel and traffic, as the lake would give easy access to the surrounding countries, and develop this part of Africa to an extent thus far utterly undreamed of.

But it is well to look also at the disadvantages of this gigantic scheme. In the first place, it will rob the ocean of such an enormous amount of water that its general surface will be lowered to an appreciable extent. In order to realize how much this lowering will amount to, let us consider that the total terrestrial surface is, in round numbers, 200,000,000 square miles, of which the ocean occupies three quarters, or 150,000,000. If the estimate given of the Desert of Sahara, 4,000,000 square miles, is correct, it occupies $\frac{1}{38}$ part of the ocean's surface, and, therefore, every foot of depth of water abstracted for the Desert will diminish the ocean $\frac{1}{38}$ part of a foot; and the withdrawal of water for a lake 80 feet deep would leave the ocean level $80 \times \frac{1}{38}$, or more than two feet lower, which would be plainly perceptible in the many harbors where careful tidal observations are made, and in some cases changes may influence the shipping, robbing as it would do all parts of the world of over two feet depth of water, which would be very bad in those localities where the harbors are shallow.

This much as to an immediate result; but the ultimate consequences would be much more serious. It should be considered that this large inland lake, if once established, would have no fresh water supply, by rivers; but the sea water would certainly rush in through the channel, to make up for the large evaporation, which we may safely set down at 1,200 lbs. of water per year for every square foot. This would lower the level 20 feet per year, which is one quarter of the whole quantity of the lake. This, for a surface of 4,000,000 square miles, or 100,000,000,000,000 square feet, gives 2,000,000,000,000,000 cubic feet of water to be replaced annually from the ocean, or nearly 6,000,000,000,000 cubic feet per day, or 250,000,000,000 cubic feet per hour, or 4,166,666,666 cubic feet per minute, or 69,444,444 cubic feet or 525,000,000 gallons per second. As the German Rhine carries only 1,000,000 gallons of water per second, on an average, the channel bringing the supply to the Desert of Sahara from the ocean would have to carry as much water as is carried by 525 rivers like the Rhine; and from the salt water only pure water would be evaporated, leaving the salt behind. As this amounts to 4 per cent, or $\frac{1}{25}$ of the sea water, and as nearly 20 feet deep, or $\frac{1}{4}$ of the water in this new lake, would annually evaporate, it would only take 4×25, or 100 years, one single century, for all the water to disappear, and a deposit of salt take its place. Then the now sandy desert would be changed into a desert of salt: which salt would fill the whole basin, and would certainly be a more serious affliction to Algeria than the present sand plain can possibly be.

THE THORNEYCROFT FAST LAUNCHES.

In a recent description of the French torpedo experiments at Cherbourg, we noted the wonderful speed of nearly 19 knots per hour attained by a steel torpedo launch built by Messrs. Thorneycroft. In such small craft, displacing at most but about 15 tons, this extreme velocity appears to be obtainable only over short periods; but a speed of 18 knots has been maintained over measured distances for more than two consecutive hours, the engine then developing 220 horse power. The dimensions of a launch which attained this speed are as follows: Length 63·04 feet, beam 8·53 feet, draught of water (average) 2 feet, displacement (that is to say, the total weight of the vessel and all its contents) 15 tons.

While there can be no question but that these vessels demonstrate remarkable progress in navigation, on the other hand this achievement cannot be attributed to any new discovery, but results from improved application of known principles, and especially from the rare perfection of the construction of the motive apparatus, which develops great power, while its weight is reduced to the narrowest limits. This, however, it not the only element of success. The model of the hull is such as to diminish to the utmost the liquid resistance opposed to its onward movement. Again, the material of which the hull is built is such as not to absorb by its weight a fraction of the total displacement which may be usefully devoted to the motive machinery. To this end it is built of steel plates, and weighs but 9,900 lbs., or less than a third of the total displacement. In order that the propeller should afford the maximum effect, it is necessary that the liquid vein upon which it acts should be as large as possible in comparison with the resistant section of the vessel. Ordinarily the section of vein acted upon is less than the latter. In the Thorneycroft launch, the screw shaft is placed on a level with the keel, instead of being located at a point half way between the keel and the water line, as is usually the case. The screw then projects below the keel for nearly half its diameter, and consequently it acts upon a section of vein greater in area than the greatest section of the vessel. This arrangement doubtless contributes materially to the speed; while a sharp bend of the keel protects the propeller from damage.

As already noted, Messrs. Thorneycroft's success in producing a motor both light and powerful has been remarkable. The complete machine—that is, including boilers and the water contained—weighs in all 16,060 lbs. The power at the speed of 18¾ knots having been 220 horse, the weight is therefore but 72·6 lbs. per horse power. The machinery is therefore probably the lightest ever produced for purposes of navigation. Large marine engines for a long time rarely weighed less than 440 lbs. per horse power; and it is only through recent improvements that this has been reduced to 330 lbs. For ordinary launches, with non-condensing engines running at high velocities, the usual weight per horse power is about 220 lbs. It is therefore interesting to note under what conditions Messrs. Thorneycroft's engines are produced. They are condensing machines, two cylinder, on the compound system. The boilers are of the locomotive type, with the difference that the tubular surface is reduced about one half. This is the only sacrifice which has been made for the economic production of power; and it was necessary in order to reduce the weight of the apparatus. The safety valves are loaded to 13·2 lbs. The engine makes 430 revolutions per minute, which requires great mechanical excellence of the mechanism, and especially of the air pump. The consumption of coal per horse power per hour is 3·52 lbs. The grate surface is 11·19 square feet. An artificial blast is conducted directly to the fire chamber instead of to the ashpit.

THE PERMANENT SUPPLY WATER WORKS OF BALTIMORE.

One of the greatest engineering works now in progress is that to supply the city of Baltimore with water, and the gentlemen in charge of it have been so busy pushing it forward that they have had very little time to talk about it: in consequence of which not many people outside of the city know anything of it, and comparatively few have any idea of the immensity and difficulty of the works that are now so quietly progressing to supply them with an almost unlimited supply of the necessary article of water. One of our correspondents lately called on Mr. Robert K. Martin, the engineer in charge, who was so obliging as to show him over the line of works, and we are thus enabled to lay the following particulars before our readers.

Baltimore is at present supplied with works having a capacity of about 15,000,000 gallons a day, which comes from Jones' Falls to Lake Roland, whence it is brought by a conduit 3¾ miles long to Hampden reservoir and Druid Lake. From the latter, which is 53 acres in extent and 217 feet above tide, one portion of the water is raised by powerful steam pumps to a high service reservoir 350 feet above tide, for supplying the highest region of the city; a second part is supplied direct to the mains; and still another portion is allowed to pass to Mount Royal reservoir, which is only 150 feet above tide, so as not to give too high a pressure to the lowest portion of the city.

This supply having been found to be insufficient in the summer season, it was resolved to increase it temporarily by erecting, near the Gunpowder River, a pair of Worthington's duplex compound pumping engines, capable of raising 10,000,000 gallons a day from that river, over a hill 265 feet high, to Roland Run, a tributary of Jones' Falls above mentioned. This arrangement, however, was not sufficient for some of the more enterprising of the Baltimoreans, and a new plan was devised; and it is now being carried out, notwithstanding considerable opposition by interested parties, by the capable and energetic civil engineer of the Water Commission, Mr. R. K. Martin, who had charge of the previous works, erected in 1858. The source of the new supply is the Gunpowder River, which at about nine miles from Baltimore makes its nearest approach to the city, as at this point it takes a bend in another direction. Advantage is taken of this turn to form a dam across the stream, and so form a storage lake which will, it is believed, be capable of supplying the city with 175,000,000 gallons of water every twenty-four hours. This lake will be from 500 to 1,000 feet wide, about 20 feet deep on the average, and will extend up

© 1877 SCIENTIFIC AMERICAN, INC.

the Gunpowder a distance of about 5 miles through the most picturesque scenery, which is constantly changing, as the river and the valley through which it runs pursue a very devious course between ranges of precipitous, wooded hills, from where it leaves the open country near Meredith's Ford bridge, which forms the head of the lake. To facilitate operations, a road 10 miles long, about 30 feet wide, and about 10 above the intended level of the lake, has been cut in the sides of the hills on each side, which will no doubt be utilized hereafter as a pleasure drive by the lovers of beautiful scenery.

At the lower end of the site chosen for the lake, two hills jut out into the valley, leaving but a comparatively narrow place, of which advantage is taken to form a dam which will raise the water about twenty feet above the natural level of the river. In one of these hills is the mouth of the tunnel, hereafter referred to, from the side of which a dam will be built having an overfall of 300 feet and a wing of 190 feet, that will extend into the opposite hill. This dam will be of the most substantial character, of heavy stone laid in hydraulic cement. The stone work will be 31 feet high and about 65 at the base, having its foundation on the solid rock; and it is estimated that about 20,000 perches of stone will be required for this part alone. The face of the overfall will be built of large blocks from three to four feet in depth; and to prevent any undermining, an apron is to be cut below the overfall resting four feet below any of the other foundations. The other side of the dam will be protected by a backing of 165 feet of puddle clay, gravel, and riprapping. The parapet walls will rise 12 feet above the overfall, and will be level with the floor of a gate house that is to be erected at the tunnel end of the dam. At the gate house begins the tunnel, which is to carry the water to Lake Montebello. This tunnel is nearly seven miles long—36,510 feet—and is therefore the longest in the country. The bore is circular in shape and is 12 feet in diameter. Over five miles of it will be through hard gneiss, which is being cut with drills driven by manual labor, as the contractors think that, owing to the comparatively small area of the tunnel, the power drills are not economical enough to pay them for the cost of the necessary machinery. A portion of the tunnel is being cut through softer material—a kind of limestone, that crumbles into powder by the force of the explosion when blasted. This part of the tunnel will have to be bricked; but where the gneiss occurs, the brickwork will be dispensed with, except in some localities where there are bad breaks and crevices in the rock, and at the bottoms of the shafts which will, when the tunnel is completed, be arched over with masonry 6 feet thick, to withstand the immense pressure of the loose earth filled in above.

To facilitate the operations in the tunnel, fifteen shafts, from 65 to 300 feet deep, have been sunk, most of which are down to grade; and in some of them considerable work has been done on the tunnel. But owing to the hardness of the rock for the larger portion of the distance, very fast progress cannot be made—only about a running foot of tunnel per shift of 12 hours, or two feet per day, as in tunneling night and day are alike so far as work is concerned, the only light in either case being that obtained from the small lamps attached to the miners' hats. As before stated, the contractors employ manual power for drilling, which, in the hard work, is done by task work—thirteen feet per shift being the miner's task. The holes are bored 30 inches deep, and an eight ounce cartridge of giant powder (nitro-glycerin and sawdust) is used in each hole, at which rate about 7 lbs. of powder, at 40 cents per lb., is used for each running foot of hard rock tunnel, making for the five miles through the gneiss nearly $74,000 for explosives alone, to say nothing of that used in the other portions of the work.

The shafts are from 8 x 17 to 8 x 20 feet inside the timber work, which, when used, adds about 30 inches to the above figures; and as fast as they are completed they are fitted with improved safety cages to prevent accidents from the hoisting mechanism; but they have only the ordinary tipping bucket until the shaft is down to grade. The exhaust from hoisting engines is utilized to create a draught in a pipe, the mouth of which is near the heading, and by this means ventilation is secured in the tunnel.

In the limestone portion of the tunnel, between shafts 1 and 2, the stratum makes an eccentric dip, leaving a "pocket" of mud which, as the miners were working towards it, suddenly ran into the tunnel, overwhelming and suffocating one poor fellow who had been driven by it against the timbers; but the remainder of the workmen managed to escape. In this, as in some other sections, the water forms a great hindrance to operations, a spring being found here which keeps a steam pump of a capacity of 200 gallons a minute constantly at work, while about the same quantity of water percolates through other crevices in the rocky sides of this section of the tunnel and has to be removed by another pump of the same size. The same trouble occurs in other shafts, especially No. 5.

To make the necessary observations required to properly line and level the tunnel, a straight line has been made over the tops of the hills and through the woods, and three observatories have been erected for this purpose. As an instance of the great care taken by Mr. Martin in this matter, it may be stated that these structures are double, consisting of an inner tower (on which the instruments are placed) protected from atmospheric and other influences by an outer one, entirely detached from the other, on which the engineer stands when making his observations.

At the lower end of the tunnel is to be located a reservoir, to be known as Lake Montebello, which is being formed by damming up a valley admirably suited to the use to which it is being put. The upper and lower ends of the valley, forming the east and west sides of the reservoir, will be closed up with dams of stone and earth, 450 feet wide at the base and 100 feet at the top, with each end imbedded in the hills at the sides, so that the greatest possible strength may be obtained; for this is one of the most critical pieces of construction along the whole line, as these dams will have to sustain the pressure of 600,000,000 gallons of water. The north and south sides of the valley, about 3,500 feet each, will form the other sides of the reservoir, which, when completed, will have the appearance of a natural lake, and will have a superficial area of about 80 acres and a depth of at least 30 feet. The sides will be finished with riprapping, and the top will be surrounded by a fine road 1½ miles long and from 60 to 80 feet wide, divided from the reservoir by a neat and substantial iron fence.

There being a stream running through this valley whose water is too impure to be used, a drainage tunnel, 2,870 feet long and of 9 feet diameter, had to be made to carry it away, which tunnel will also serve to take off the surface drainage, and to empty the reservoir, should it be required. From this reservoir, another tunnel, 2,600 feet in length and 12 feet in diameter, is now in course of construction. This tunnel is cut through soft material, and therefore requires strengthening with brickwork laid in hydraulic cement. Where the tunnel is of the right character, the top arch is three bricks thick and the invert below the spring line two bricks, with a proportionate backing of from 18 to 24 inches above the spring line, built in against the timbers or the rock wall of the tunnel. In the soft places, there is an additional ring of brickwork added, and the backing is proportionately increased. In all cases, the arch is packed over the top with clay well rammed in. The brickwork in this, as in the main and drainage tunnels, requires to be done with the greatest care, as it has to stand not only the outside pressure of the immense weight of material above it, as in railroad tunnels, but also the internal pressure of the water within, which is always searching for weak spots to break through, and it is therefore being done by the day. It is estimated that about 12,000,000 bricks will be used in all the tunnels.

One portion of this tunnel passes beneath a well, the bottom of which is only four feet from the top of the tunnel; and yet the water of the well has not been drained, and it continues to furnish its usual quantity of water, notwithstanding that another well, 300 feet from the tunnel, was almost immediately drained and has now no water whatever.

At the end of this tunnel will be a gate house from which the water will pass into six pipes of 48 inches diameter each, by which it will be conveyed to the city limits, and there connected with the present system of mains for distribution throughout the city.

Along the line of the work have sprung into being several temporary villages for the miners and laborers, showing styles of architecture that one would hardly expect to find so near a great city, varying from the tolerably comfortable offices of the contractors to that of the squalid log huts of the negro laborers on the storage lake, with a single room that is half below ground and half above. Many drinking shops have also been built on the line, or rather as near to it as they can be built (for the engineer will not allow them on the city property), in which the men squander their hard earnings after each pay day, and so unfit themselves for their labor as to cause no small delay to the progress of the work.

Unlike the officials of some other cities that may be named, those of Baltimore appear to have a fashion of completing their public works without exceeding the appropriations for them. This was the case with their city hall, inaugurated a year or two ago, and it appears as if it would be the same with the water works. The whole amount appropriated for this purpose is $4,000,000; but the engineer in charge, who is doing his best to cut down the expenses all he can without depreciating the quality of the work, thinks the whole improvement can be completed at a cost of very little, if any, over $3,000,000. About 1,500 men are employed—common laborers getting $1.25 per day and miners $1.50. It is expected that the whole work will take about three years to finish, and Baltimore will then have a natural flow through the tunnel that will supply it for generations to come with all the water for ordinary purposes that can be used or wasted, as the river at the point tapped is 170 feet above mean tide, and consequently will give water to nearly all the houses in the city, except in the extreme northwest section, for which the water will still have to be pumped into a high service reservoir.

Mr. Martin is assisted by Mr. C. P. Manning, consulting engineer, W. L. Kenley, chief assistant, and seven resident engineers, Messrs. R. B. Hook, W. R. Warfield, C. O. Swan, C. T. Manning, O. H. Balderston, and C. A. Hook, who are named in the order of the work they have in charge, beginning at the storage lake. The contractors, also named in the same order, are Messrs. Condon and Co., Fenton and Allan, Bruce and Patterson, L. B. McCabe and Brother, J. Donohue and Brother, and J. E. Eschback.

From this cursory sketch, some idea of the magnitude of the work in which the city of Baltimore is engaged may be obtained—a work alike honorable to the public spirit of her citizens and the gentlemen engaged in its construction.

THE most valuable part of a man's education is that which he receives from himself.

WHAT IS A TEMPORARY STAR?

On November 24, 1876, Professor Schmidt, Director of the Observatory at Athens, Greece, noticed a new star, of the third magnitude, in the constellation *Cygnus*. The three nights immediately preceding had been cloudy, but the star had not become visible on the night of the 20th. Astronomers throughout the world were at once notified of the discovery, and the object was diligently observed both in Europe and America. Its apparent magnitude very rapidly diminished from the date of its discovery. In a few weeks it became invisible to the naked eye; and in less than three months its light was no greater than that of a star of the ninth or tenth magnitude. Other instances of such phenomena are well known in the records of astronomy. The following catalogue, with the exception of the last two, is given by Humboldt:

No.	Date.	Position.	Duration of visibility.
1.	July, 134 A.B.,	in *Scorpio.*	Doubtful.
2.	Dec., 123 A.D.,	in *Ophiucus*	"
3.	Dec. 10, 173 "	in *Centaurus*	8 months.
4.	March, 369 "	Doubtful	6 "
5.	April, 386 "	in *Sagittarius*	3 "
6.	389 "	in *Aquila*	3 weeks.
7.	March, 393 "	in *Scorpio*	Doubtful.
8.	827 "	(?) in *Scorpio*	4 months.
9.	945 "	near *Cassiopeia*	Doubtful.
10.	May, 1012 "	in *Aries*	3 months.
11.	July, 1203 "	in *Scorpio*	Doubtful.
12.	Dec., 1230 "	in *Ophiuchus*	3 months.
13.	1264 "	near *Cassiopeia*	Doubtful.
14.	Nov. 11, 1572 "	in *Cassiopeia*	17 months.
15.	1578 "	Doubtful	Doubtful.
16.	July 1, 1584 "	in *Scorpio*	"
17.	Oct. 10, 1604 "	in *Ophiuchus*	17 months.
18.	1609 "	Doubtful	Doubtful.
19.	June 20, 1670 "	in *Vulpes*	20 months.
20.	April 28, 1848 "	in *Ophiuchus*	Doubtful.
21.	May 12, 1866 "	in *Coronæ Borealis*	"
22.	Nov. 24, 1876 "	in *Cygnus*	"

"It is worthy of especial notice," Sir John Herschel remarks, "that all the stars of this kind on record, of which the places are distinctly indicated, have occurred, without exception, in or close upon the borders of the Milky Way, and that only within the following semicircle, the preceding having offered no example of the kind." The striking fact here noticed indicates the existence of unknown physical conditions in this portion of the heavens, favorable to the production of the phenomena described.

Again, while two or three of the recent temporary stars have remained visible as small telescopic objects of somewhat variable brightness, yet in no case has an outburst occurred in precisely the same locality with a previous one. The supposed identity of the stars of 945, 1264, and 1572, cannot therefore be sustained, and the assumption that "all the temporary stars are simply variable stars" of long period is wholly destitute of support.

CAN THE PHENOMENA BE EXPLAINED WITHOUT THE ASSUMPTION OF AN UNKNOWN CAUSE?

It is a remarkable feature of the binary systems among the fixed stars that the orbits have great eccentricity, the less component in its periastron passage coming into very close proximity to the greater. This approach, in several known instances, is within less than the earth's distance from the sun, and, in at least one case, less than that of Mercury. Among the large and increasing number of known systems whose elements have not been determined there are probably some of still greater eccentricity. If we suppose in such case that the principal star is still in a gaseous condition, and that the radius of its atmosphere is greater than the periastron distance of its companion, the latter will at each return, by plunging through this atmosphere, produce an increased degree of light and heat. Its period will become shorter at each successive return, until it shall be arrested by penetrating the denser strata of the principal star. Its orbital motion will thus be converted into heat and the phenomena of a new or temporary star may be presented to distant spectators. Such collisions as we have supposed must have occurred very frequently in the solar system when the sun's diameter was much greater than at present, as comets of small perihelion distance would be absorbed by the central mass.

"The circumstance," says Humboldt, "that almost all these new stars burst forth at once with extreme brilliancy, as stars of the first magnitude, and even with still stronger scintillation, and that they do not appear, at least to the naked eye, to increase gradually in brightness is, in my opinion, a singular peculiarity, and one well deserving of consideration."* The fact here stated is in manifest harmony with the theory above proposed. It is worthy of note, moreover, that the part of the heavens in which the outbursts have occurred is rich in double stars and sidereal clusters.

Bloomington, Ind. DANIEL KIRKWOOD.

A Simple Fire Escape.

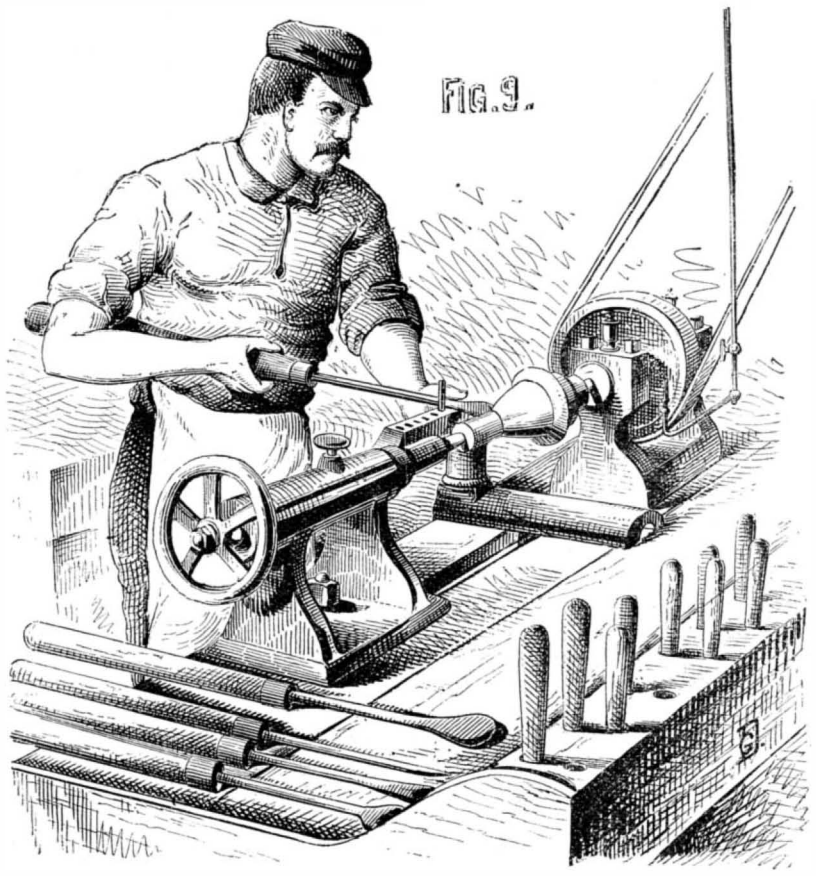
J. R. M. writes to suggest that a piece of stout canvas, about 20 feet square, with hand loops all around it, could be held in the hands of a few men under the windows of a burning house. Persons could then jump from the windows with safety, especially if the handles were attached to the canvas with rubber or wire springs, which would give elasticity to the canvas, and break the fall of the person jumping from the window.

* "Cosmos," vol. III., page 218.

© 1877 SCIENTIFIC AMERICAN, INC.

THE MANUFACTURE OF SILVERWARE.

There are certain industries which grade so insensibly into the fine arts that, in referring to those who follow them, one scarcely knows whether to use the terms workmen or artists. The manufacture of jewelry is one of these callings, that of silverware is another. The casual looker-on, seeing men with metal tools and hammers in their hands, bending over their benches, working at some dull-looking metal, instinctively regards them as mere manual laborers engaged upon no arduous task; but if he glances over their shoulders, and sees the ductile metal under their manipulation assume the most exquisite shapes, if he witnesses work produced not only of marvelous delicacy, but bearing the imprint of genius in every detail, the simple tools and begrimed garb of the workers are noticed no longer, and a feeling of genuine admiration comes uppermost in the mind capable of appreciating true artistic skill. Silver working has its prosaic side; for, despite beautiful ornamentation, forks and spoons are the commonest of every-day articles, and teapots, as teapots, are not conducive to lofty reflections. But on the other hand, such homely objects tend to make the industry what it is—art-workmanship, or to render it a link between the ideal and the actual, a means of adaptation of the airy conceptions of the artist to forms of utility. The manufacture of silverware may be divided into two parts: first, such as relates to the production of forks, spoons, and like small objects of definite form; and secondly, that relating to the making of hollow ware, which includes vessels of every description, whether for use or ornament. We propose in the following article to trace the various processes as practised at the largest establishment devoted to such work in the country—that of the well known firm of Tiffany & Co., of this city.



THE SPINNER AT WORK.

REPOUSSE WORK.—SNARLING.

The silver, to fit it for use, is alloyed with copper in the proportion of 0·075 copper to 0·925 of silver. The metal, on its reception at the factory, is weighed and tested to determine its standard quality, and is then sent to the melting hearth to be run into ingots of proper size. The operation of melting is represented in Fig. 1. (See front page.) The charge in each crucible is from 400 to 450 ozs., which, on becoming fused, is poured into either a skillet mold or else run into bars. The skillet is an ingot about 10 inches long by 6 inches broad, and 1½ inches thick, and is used for making the plates subsequently spun into hollow ware. The bars from which spoons, etc., are produced are some 20 inches in length, 1¼ inches in width, and ¾ inch thick. As in these two forms of the metal are the starting points respectively of the two departments of the manufacture above noted, we shall trace the operations upon each separately, beginning with

THE MAKING OF FORKS AND SPOONS.

The bar of silver alloy above mentioned is placed between heavy rolls (Fig. 2, front page) and flattened out to ¼ inch in thickness. Ponderous shears then cut it into suitable lengths for the individual articles to be produced; and then rolling in a transverse direction flattens that portion which is to form the bowl of the spoon or tines of the fork, until at such part the width is about 2⅓ inches. The blank, as it is termed, is now of the shape of A (Fig. 3, front page). It is then placed in dies in a drop press; and on the fall of the hammer, it emerges in the shape shown at B in the same figure. Next follows the rolling; and this involves the use of one of the most expensive machines employed. The outlay is incurred in the manufacture of the steel rolls, a pair of which is shown in Fig. 4 (see front page). On a single pair may be cut stamps for seven different articles. Thus we found the necessary patterns for dessert, table, tea, salt, and mustard spoons, besides those for large and small forks, on the two rolls represented, which, though quite small in size, cost about a thousand dollars to engrave. The designs are cut directly upon the cylindrical surface, and the metal is subsequently case-hardened. In operating the machine, the rolls are set in motion, and the workman inserts blanks for the articles desired, as the respective dies rotate in front of him. As the metal enters the rolls, it is caught by the deep notches made beside the pattern, and is thus prevented from slipping. On emerging, a spoon blank appears as in Fig. 5 (see front page). The pattern is perfectly stamped; but the bowl is flat, and around the spoon now outlined is a large amount of superfluous metal, which is clipped off by hand shears, the pieces falling into a locked box. Then the blank is carried to a file wheel, which removes all the material close up to the edge of the pattern; and if a fork is being made, a rotary file cuts the spaces between the tines.

REPOUSSE WORK.—CHASING.

The next operation is forming the bowls of spoons or the curved portions of other objects. This is done under the drop press by steel stamps, which force the portions to be curved into matrices made of tin. This metal is used because it is softer than the silver alloy, and yields to the raised portion of the ornamentation on the under side of the object as the blow is delivered. If the matrix were of steel, the ornament would, of course, be flattened out. The operation of drop pressing is shown in Fig. 6 (see front page). At A, a tin die for a spoon is separately exhibited.

The proper curve to the handle of the spoon is imparted by setting with a wooden mallet. Then follows smooth filing and weighing of the objects previous to their polishing. As a rule, about one third the metal in the original piece cut from the bar remains in the spoon; and during the various operations detailed, the absolute waste of material rarely exceeds 3 per cent. Nothing further is necessary but the buffing and polishing, which is done on wheels rotating at about 2,000 revolutions per minute, oil and sand being first used and then ordinary rouge powder. Fig. 7 (see front page) represents the polishing room. Meanwhile the elegant boxes, satin-lined and Russia-leather-covered, are being prepared from copper models of the objects which they are to contain; and in these receptacles, the gracefully shaped articles, dazzling in their fresh polish, repose in the sales-rooms of the iron palace on Union Square.

We may now retrace our steps back to the murky basement where the silver is melted and rolled, and thence follow the skillets in their final manufacture into hollow ware.

THE MANUFACTURE OF SILVER HOLLOW WARE.

Each skillet is passed some twenty times through the heavy 24 inch face rolls before mentioned (Fig. 2, front page), until it is reduced to a thickness indicated by 26 wire gauge (Brown and Sharpe's). Meanwhile the designers have produced detail drawings of the object to be manufactured, a pitcher, for example, of the form shown in Fig. 8 (front page). With the plate before him, a workman marks on the silver the lines laid down in the drawing, and, following them, rapidly cuts out the object. Our pitcher is now an assemblage of disks. Two, which answer to the upper and lower hemispheres of the lower portion; another forms the cover, and still another is to be made into the slightly flared straight intermediate portion. Then there are two narrow strips from which the ornamental bands are to be made. The decorative object on the cover and the handle are not provided for; but these we shall refer to further on.

The materials which are to be rendered concave are sent to a spinner, who has before him the drawing and a wooden pattern of the shape of the desired bowl. He pinches a disk in the fixed center screw of his lathe between two flat surfaces of wood, one of which is the wooden pattern. A burnisher resting against a pin in the lathe rest is now applied near the center of the metal, and the latter is gradually but rapidly bent or arranged until it fits close against the curved face of the block. The spinner at his work is represented in Fig. 9. The disks which are to form the upper part of the pitcher, globe, and also the cover, are treated in a similar manner, and the square-shaped pieces are flared by a similar process. While this is in progress, the narrow strips which are to form the ornamental bands are passed between engraved rolls, which impress upon them a suitable pattern. Their ends are soldered together, and they are bent around formers which give them the requisite flaring shape. Now the various parts of the pitcher being completed, nothing remains but to solder them neatly together, and the vessel assumes its desired form.

The handle and ornament for the cover, having been moulded in wax, and clay moulds prepared, are cast, an operation of the greatest delicacy, inasmuch as there is an immense amount of intricate undercutting work to look after. The moulds are made in fragments of every possible shape, and all are numbered so that they can be readily put together. At this stage, the handle and cover being affixed, our pitcher

© 1877 SCIENTIFIC AMERICAN, INC.

may be deemed complete. That is, it may be buffed and polished, and we should have a handsome plain article with a little tasty ornamentation on handle, cover, and on the fillets. If, instead of a pitcher, we had selected a snuff-box or waiter as our example, the spinning process would of course have been omitted, and the bent portions, forming the *bouge* (or bulge) of the waiter or sides of the snuff-box, would have been hammered over formers. No matter what the article is, however, the manufacture might as stated end here; but should we require an elegantly decorated object, we step at this point out of the region of handiwork and at once enter the realms of fine art.

HOW SILVER IS DECORATED.

We shall now proceed to explain the various ways in which our pitcher might be ornamented, and of these the simplest is the satin finish. This is done by a patented implement, small in itself, but, like a great many other little articles, very important in the office it performs. The object, having been polished, is held against a revolving bunch of fine brass wires, the latter being loosely held to the hub of a wheel. A stream of soapy water runs down on the brush while it is in revolution. The silver, being held up to the moving wires, is thus covered with minute stratches which finally produce upon the surface the soft sheen of satin. This is one of the most beautiful finishes that the metal can receive, and the rapidity with which it is done is remarkable.

Still more ornate is the flat chasing. By this process, tasteful figures are produced on the silver by dots and lines made with a punching tool. No metal is cut away; and in this respect the operation differs from engraving, in which sharp cutting gravers are employed to produce the design in sunken lines. *Appliqué* work is just the reverse of the foregoing, as the ornaments, instead of being made by indenting or removing the metal, are added by affixing portions to the surface. The metal is previously rolled or stamped into figures, scrolls, or braids, and these are simply soldered on the object to be ornamented. When finished, silverware in *appliqué* resembles that decorated by the *repoussé* process, which forms the subject of Figs. 10 and 11.

Repoussé work is probably the highest branch of the silversmith's art, and calls for the most consummate skill. The name means "repulsed" or "pushed back" work, and is applied because the metal is raised by hammering on the object from within, that is, it is dented outward. As it would be manifestly impossible to insert a hammer in many small narrow-necked vessels, or to use it in any hollow object with any convenience, the snarling tool is employed. This is simply a metal bar having one end bent and secured in a vise and the other turned upward and tapered to a dull point. The design having been scratched lightly on the exterior of the object, the latter is slipped over the bar, so that the vertical end of the same comes just under the portions which it is desired to have in relief. The workman then taps lightly on the snarling iron, close to the vise. The resiliency of the bar causes the blows to be transferred to the silver; and at the same time it tends somewhat to equalize their force. As soon as the entire pattern is raised, the vessel is annealed because the hammering hardens the silver, and the subsequent operations depend entirely upon its ductility. If the ornamentation is to be in very high relief, the snarling is repeated, and the ornamentation raised still higher. Then another annealing follows, and so on, until the artist judges that the raised parts sufficiently protrude.

The vessel is now filled with a resin composition, which sets hard and gives a firm backing, and is then placed on a pad before the artist who does the chasing, Fig. 11. This chasing differs from the flat chasing previously noted, in being a very much more elaborate process. The artist has before him hundreds of minute steel punches, and with these he literally pushes the metal into the designs called for by the drawing. To make a raised flower, for example, he has first merely a bulge on the surface produced by the snarling tool. With his little punches, he pushes certain parts of the metal under the edges of the protrusion, throws up other portions, and finally the shapeless swelling is converted into the thin delicate flower petals, in full relief from the surface. Of course this is very costly and very lengthy work. We were shown a single tea set of four pieces—all quite small—which were covered with exquisite flowers and arabesques, and on which one man had worked for eighteen months. The price of the articles was $1,500—a large sum to pay for the objects intrinsically considered, but not at all excessive when the work lavished on them is remembered. Ornaments for race cups and other decorations not attached to the surface are cast and afterwards carved.

There are three more processes for decorating silver, which we have yet briefly to review. Gilding is resorted to, not only for lining the interior of vessels but for producing tasteful designs on the exterior. The gold is deposited, by the electro-plating bath, upon such portions of the articles as may be desired, all of the surface of the latter save the pattern to be gilded being covered with wax. Enameling is an art by itself, and would form the subject of a paper even longer than the present general summary of the industry. It will suffice to say that the design is first engraved upon the object. Then the enamel, mixed with a little water into a paste, is painted in the incised portions. The article is then fired in a special furnace; the enamel fuses, vitrifies, and, when complete, is nothing more than colored glass inlaid in silver. A very beautiful mode of ornamentation which was practised in the middle ages, but which has remained for centuries almost unused until revived by Messrs. Tiffany & Co., is niello work, or the inlaying of silver with different metals and compositions. A black enamel and red copper are used, the first being inserted in the incised portion of the work by the process above described, and the second, by electro-deposition. The effect of the rich color of the copper and the solid black of the enamel, in contrast with the pure white luster of the silver, is exceedingly fine.

In Fig. 12 is represented the famous Bryant vase, a magnificent specimen of *repoussé* silver work, made at a cost of $10,000. The ornamentation is in high relief and chased with wonderful delicacy. This splendid work of art is intended to symbolize Mr. Bryant's life and character through the medium of a classic form, covered with ornamentation drawn from Nature, and suggested by his works. The heavier lines of the fretwork are derived from the apple branch. Poetry is symbolized by the eglantine, and immortality by the amaranth, which is said never to lose its fragrance, and these are blended with the lines formed of the apple branch. The primrose, for early youth, and ivy, for age, form a border directly above the handles. Encircling the neck at the narrowest part, the immortal line "Truth crushed to earth shall rise again," is rendered *verbatim*, the beginning and end being separated by a representation of the fringed gentian, which Mr. Bryant remembers in one of his poems as always pointing to heaven. Eras in the poet's life are illustrated by a series of bas-reliefs. In the first, he is a child, looking up with veneration at a bust of Homer, to which his father points as a model. The second shows him in the woods, reclining in a meditative attitude. Between the first and second of these medallion pictures, is a portrait of the poet, laurel-crowned. Above this, the lyre for Mr. Bryant's verse, and beneath, the most primitive printing press, in remembrance of his connection for over half a century with the New York *Evening Post*.

Fig. 12.—THE BRYANT VASE.

In a smaller medallion is the waterfowl, used by Mr. Bryant as an emblem of faith. The ornament around the lower part of the vase is of the Indian corn, with a single band of cotton leaves, and at the foot is the water lily. The designer has introduced these symbols from Nature, as the fittest means of illustrating the life of an author whose writings teem with symbols drawn from the same source.

It would be remiss on our part to close this article with merely a cordial acknowledgment of the courtesy with which every detail of the manufacture we have described was submitted to our inspection. The work which Messrs. Tiffany & Co. are now carrying on is of national importance; for their establishment is not only a great business concern but a school of art. In this country, where art museums and similar means of educating popular taste are few and far between, our people are in large measure dependent upon the art industries of Europe; and an immense amount of money is yearly expended in the importation of objects of ornament made abroad, which could be equally well manufactured here, did the requisite degree of cultivated artistic skill exist among us. This fact is now well recognized, and efforts are being made by public spirited men to provide the necessary collections whereon correct standards of taste are based; but Messrs. Tiffany & Co. are doing even more than this, for they are directly educating men as art workers. In the designing department of their factory, boys are admitted at an early age and taught to design; and already many superior workmen and artists have in this way been made.

A Tremendous Mining Blast.

On April 19, a mass of iron ore, reaching to a height of 170 feet from the base and perforated with three large arches, was blown to fragments. It was situated in the famous "21 Mine" of the Port Henry Iron Ore Company, Essex county, N. Y. The mine had been dug to a depth of 300 feet and a diameter of 600 feet, in the center of which stood the mass to be broken up, which contained nearly 80,000 tons of the finest iron ore. In the pillars which formed the arches, 100 holes were drilled horizontally, of 3 inches diameter, some of them being 40 feet deep. The holes were completely filled with vigorite, a new explosive; and the charges were fired by electricity, in two blasts. The first was completely successful, but it somewhat marred the effect of the second by breaking some of the electric wires; 40,000 tons of ore were thrown down, and will be removed before the remaining charges of the second blast will be fired.

New Facts about Iceland Spar.

Professor A. K. Eaton, of Brooklyn, widely known as the inventor of an improved spectroscope, describes in the *American Chemist* a curious fact about Iceland spar. Hitherto the statement has been currently made and accepted that the axis of the crystal is the only direction along which there is no display of the curious property of the spar—double refraction. Wishing to obtain the widest possible divergence of the two rays from the spar, Professor Eaton cut it in planes perpendicular to the axis of the crystal; and to his great surprise, instead of getting the utmost separation of the rays, he found no double refraction perceptible. Finally he cut a crystal in the form of a sphere, and, by experiments upon it, ascertained that the two images of the ray are superposed on each other, so as to make no double refraction, not only when the ray passes through the axis, but also when it passes through in a plane direction perpendicular to the axis. From Professor Eaton's diagram it appears that the greatest divergence is to be attained by passing the ray through at an angle of 45° to the axis of the crystal. The fact is decidedly important in the use of the polariscope.

Driving Horses by Electricity.

The French papers describe an invention for driving horses by electricity. The coachman is to have under his seat an electro-magnetic apparatus, which he works by a little handle. One wire is carried through the rein to the bit and carried to the crupper, so that a current once set up goes the entire length of the animal along the spine. A sudden shock will, we are gravely assured, stop the most violent runaway or the most obstinate jibber. The creature, however strong and vicious, is transformed into a sort of inoffensive horse of wood, with the feet firmly nailed to the ground." Curiously enough, the opposite effect may be produced by a succession of small shocks. Under the influence of these the veriest screw can be endowed with a vigor and fire indescribable.

A Wonderful Spouting Well.

According to the *Miner*, the town of Wilcox, Pa., possesses a remarkable curiosity in the shape of a spouting gas well: It says: "There is an immense reservoir of gas in the hole, together with a seemingly endless supply of water, and there is evidently a gigantic and never-ceasing struggle between the two elements for the mastery. For a few moments the gas will throw the water to the height of one or two hundred feet, followed (by igniting the gas) by a volume of fire. Then the water will run back into the hole.

© 1877 SCIENTIFIC AMERICAN, INC.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

The amount of cash receipts at the Patent Office would seem to indicate that business was revivíng there as well as elsewhere—the money received on Friday of last week being over five thousand dollars, the largest amount, with one exception, ever realized in any one day since the establishment of the Office.

A few days since there was a report in the papers that Secretary Schurz would soon hear charges made against Commissioner Spear by J. McCleary Perkins, which was followed by this paragraph in the *Republican :*

"The statement that Secretary Schurz was to hear the evidence on certain charges made by one J. McCleary Perkins against Commissioner Spear, of the Patent Office, had no foundation in fact. There are several charges now pending against Perkins which may, when the Secretary finds time to examine them, result in barring Perkins from practising before the Department, and which will doubtless be heard before any charges preferred by Perkins against any officer of the Government."

From this, it would appear that Mr. J. McCleary Perkins does not get along quite as well with the present Commissioner as he did for a time with the last one. Shortly after Mr. Duell took his seat, Mr. Perkins, having much more time on his hands than clients to occupy it, undertook to oversee the business of the Office. For a time, it seemed, from the authority he assumed, that he considered himself as Acting Commissioner, or at least Assistant Commissioner. and actually took possession of and occupied a desk in one of the rooms for his own private business, until Mr. Duell got tired of his officiousness, and he was refused its further use, since which time he has become what one of our papers calls him—"a chronic grumbler."

There has been a vacancy for some time past in the Board of Appeals, owing to the inability of Mr. Marble to take the position on it to which he had been appointed, as he was filling another office; and having now been appointed Assistant Attorney General, he has formally declined the position. It having been determined to fill the vacant office by a competitive examination, the Commissioner, Assistant Commissioner, and Assistant Attorney General were appointed as an examining board, before whom the following gentlemen who competed for the position were examined: Messrs. Fox, Wilkinson, Dyrenforth, Burke, Bartlett, Hedrick, Tilden, Durnall, Bates, Wilber, Catlin, Bowen, and Antisell, all of whom are members of the examining corps, except Dr. Antisell, who formerly served in that capacity, but resigned many years since. The examination is said to have been entirely practical, and to have reference to office work only. The board will examine the papers as soon as they can spare time from their current work, and report the three last to the Secretary, who will then nominate one to the President for appointment.

Application having been made by a printing firm in your city to register as a label a print representing a race course, without any descriptive matter thereon, the intention being to sell the print to customers to ornament their goods, the examiner rejected it on the ground that it should be registered as a trade mark, if registered at all; but the Assistant Commissioner on appeal decided that such a print does not meet the requirement of a trade mark or copyright, and that it should therefore be properly registered as a label, as it is not to be considered as a work of art, but is to be used for "other articles of manufacture."

Reports from nearly nine hundred counties in which winter wheat is raised have been received by the Agricultural Department, of which about one quarter are unfavorable; but in the remainder the yield promises to be from average to superior. Of three hundred and twenty counties in the Ohio basin, only forty-five report below the average. Grasshopper ravages are reported in twenty-two counties of Kansas, and the wheat-growing districts of Texas are said to be alive with these insects. There is, however, an increase of the area of wheat in the latter State, and the prospects are favorable in other respects. In the other cotton States, a dry autumn and variable winter have depressed the condition of wheat below the average.

The sixth report of the Government Inspector of the works for the improvement of the South Pass of the Mississippi is just received; from which it appears that, since November 18, 1876, about 16,000 cubic yards of material have been dredged at points where the channel was the worst. A part of the west jetty has been raised by mattresses and a layer of stone, until it is of a height of from six inches to two feet above the average flood tide; and one hundred and sixty-seven additional piles have been driven. A table accompanying the report shows that the depth between the jetties has gradually deepened from nine and two tenths feet in June, 1875, to twenty and a half feet in March of this year. At the head of the passes, the west T head has been extended up the stream, and its upper part made a solid dyke; a line of mattresses has been carried from the east T head down to the head of Goat Island; a solid mattress dam has been built across the old east entrance to the South Pass; and about 30,000 cubic yards of digging has been done. The rising of the river caused a sharp scour between the T heads, so that near twenty-four feet could be taken from the Mississippi into the South Pass on March 7, 1877.

The National Academy of Sciences is now holding its fifteenth annual session, at the Smithsonian Institute in this city. The following papers have been read up to the time of writing this:

"On a new measuring instrument, the vernier microscope," by Professor A. M. Mayer. "On systematic errors in star declination," by Professor E. C. Pickering. "On the young stages of osseous fishes," by Professor Alexander Agassiz. "On critical periods in the history of the earth, and their relations to evolutions, and on the quarternary at such a period," by Professor Joseph LeConte, of San Francisco; read by Dr. John L. LeConte. "On the progressive motions of storms," by Professor Wm. Ferrel. "On the effect produced by mixing white with colored light," by Professor O. N. Rood. "On Newton's use of the term 'indigo,' with reference to a color of the spectrum," by Professor O. N. Rood. "Improved method of obtaining metallic spectra," by Professor G. F. Barker. "On the internal structure of the earth as affecting the phenomena of precision and mutation," by General J. G. Barnard, U. S. A. "On a proposed new method of solar spectrum analysis," by Professor S. P. Langley, director of the Alleghany Observatory. "On complex inorganic acids," by Professor Wolcott Gibbs. "On a micrometer level and topographical camera," by Professor E. C. Pickering. "On the determination of the co-efficient of expansion of solids," by Professor A. M. Mayer. "On the results of deep sea dredgings," by Professor A. Agassiz. "On a new detached gravity escapement, invented by Professor Young," by Professor Barnard. "On the laws ruling the vibrations of tuning forks," by Professor A. M. Mayer.

Many of these papers and the discussions that followed were deeply interesting; and as the session will continue a day or two more, it is probable that other equally interesting subjects will be discussed. The following gentlemen were elected members: Dr. John W. Draper, of New York; Dr. Scudder, of Cambridge; Dr. Elliott Cones, Dr. Henry Draper, of New York; and Mr. C. S. Pierce, of the Coast Survey.

The War Department will, it is said, at the coming extra session of Congress, call for an appropriation for the manufacture of improved arms, so that their accumulation might place the government in readiness for any emergency. It is stated that there will not be more than about 8,000 arms of the improved patterns on hand at the close of the present year; and that if the States should draw all they are entitled to, the stock of improved arms held in reserve would be exhausted. The style of gun now being manufactured is that known as the Springfield breech-loading rifle, and it is argued that these guns should be manufactured in sufficient quantities to render a gradual accumulation of them in store a certainty, as otherwise the government may find itself without arms at a time when they may be wanted very badly. The ordnance officers are also complaining about the meagre means of defense on our coasts and harbors, asserting that we have little or no means of operating against the heavily armored ships that the European powers could bring against us, excepting the torpedo boats, which are as yet but in the experimental state. It is stated that several experimental guns have been made; but they cannot be tested, as no money has been appropriated by Congress for that purpose.

In consequence of a recent decision of the Supreme Court respecting the eight hour law, Secretary Sherman is about to issue an order that hereafter no officer shall pay ten hours' wages for eight hours' work, thus practically reversing the order of General Grant constituting eight hours a day's work.

One of our street railroads has received permission to try the dummy engines now successfully used in Philadelphia, and will shortly introduce them on both their lines, if on trial they meet with approval.

Washington, D. C. OCCASIONAL.

Letter from the Oldest Locomotive Engineer now Living.

To the Editor of the Scientific American :

I am probably the oldest living locomotive engineer in the United States, possibly in the world. In the year 1832, I think, the Schenectady and Saratoga railroad went into operation, and in that year imported a locomotive engine from England, made by George Stephenson, and named after him; an engineer named Turner came with it and ran it for some months; but as he was a man in poor health, I frequently was called upon to fill his place, as I was then superintendent of Clute & Bailey's machine shop and foundry, where the work for that road was generally done. The engine above mentioned, I think, was the first in the United States placed and run upon any railroad. The Mohawk and Hudson was the first railroad built in the State, but was operated by horse power for several years, with stationary engines at both ends for hauling up and letting down the passenger cars on the inclined planes at Albany and Schenectady. I saw a short article in some paper a few years since, saying that the locomotive engine above mentioned was still in the city of Schenectady, laid up as a curiosity in some establishment there, for I assure you it was a curiosity, when compared with those of the present day.

I have never followed the occupation of an engineer either on a steamer or locomotive regularly, having always preferred that of a machinist, so as to be at home with my family at night, although in my younger days I have frequently operated on both when necessity required it. I am now 77 years old, and for the last 35 years have been living on my farm in the mountains of Georgia, enjoying good health; I am hearty and active, and can do as good work as I ever did, and can mount a horse as spry as when 45 years old. I presume you have had a description or descriptions of the locomotive alluded to, or I would send it, as well as my recollection serves me.

Clarksville, Ga. J. VAN BUREN.

Remarkable Explosions.

To the Editor of the Scientific American :

In the year 1873, some parties in this city conceived the idea of pulverizing brimstone, which was done successfully. The product very closely resembles flowers of sulphur, and many tons of it have been sold, the greater part to sheep farmers. At the time of the first attempt, we had pulverized about a hundred tons, and were just about stopping the machinery when a terrible explosion took place; and in a few minutes the mill building was all in flames and completely destroyed. The mill at the time was full of fine dust of sulphur, especially the upper story, where it was floating thick in the air. The explosion seemed to be mainly in the upper story. There was no fire in the building, nor was there any person smoking, and the affair seemed a mystery to everybody. Many who pretended to be chemists and experts said there was nothing to be feared from grinding sulphur; but I maintained that either sulphuretted hydrogen was generated in some way by the attrition, or that the impalpable dust, mixed with the air, was the cause of the explosion. I told the mill owner that it would explode again if the attempt was repeated; but he did not mind me, and when he rebuilt the mill he tried it again. When we were just about stopping after finishing a lot of seventy tons, on July 25, 1874, another terrible explosion took place, with the same circumstances attending it as on the previous occasion. The mill was burnt to the ground. Since then the owner of the mill never tried sulphur grinding again.

San Francisco, Cal. J. W. MORRISSEY.

Pneumatic Transmission of Time.

To the Editor of the Scientific American :

In your issue of April 21, 1877, is an article on the transmission of correct time in Vienna, Austria. Allow me to state that the transmission of time by a pneumatic system has been in use in San Francisco since February, 1874, where, in the London and San Francisco Bank Building, one regulator transmits the time to 14 dials. This invention (of Mr. H. Wenzel, of San Francisco) was patented in July, 1873, and is so satisfactory that it has been also introduced in the Nevada Bank Building, with 26 dials; in the San Francisco Club House, with 8 dials; in Baldwin's Hotel, with 62 dials, and into a number of private houses. One of these clocks, with a most ingenious, original improvement on the escapement, termed "force constant," and connected with several dials, to which any number of dials in the same or adjacent buildings may be added, is now in operation, and can be seen at Mr. C. W. Schumann's office, 24 John St., this city.

New York city. L. BECKERS.

Stream Power and its Utilization.

To the Editor of the Scientific American :

An article appeared in the SCIENTIFIC AMERICAN of April 28, 1877, under the above heading, for which you credit the *Millstone.* I know not to what the *Millstone* gave credit for the article; but I am sure that it ought to have given credit for the article to the SCIENTIFIC AMERICAN of January 14, 1871. If you will refer to that number of your journal, I think that you will acknowledge that no one can be more positive as to the origin of that article than your humble servant. It is one of the weaknesses of humanity to be pleased with due thanks for one's fugitive ideas and compositions.

Worcester, Mass. F. G. WOODWARD.

American Inventive Progress.

"Under the above heading the SCIENTIFIC AMERICAN of May 7th has a long and interesting article, from which we make the following extracts:

"'To show with what rapidity inventors made improvements on inventions embodying original principles,' says the writer, 'it may be noted that, in the early days of the sewing machine, 116 patents were granted for improvements thereon in a single year; and out of the 2,910 patents issued in the year 1857, 152 were for improved cotton gins and presses, 164 for improvements on the steam engine, and 198 for novel devices relating to railroads and improvements in the rolling stock. In the year 1848, three years after the publication of this paper was commenced, but 660 patents were granted; but under the stimulus of publishing these inventions as they were patented, ten years later, in 1858, the number had increased sixfold, reaching 3,710, while up to January 1, 1850, as already stated, the aggregate of patents issued amounted to 17,467; since that time and up to the present period the total is 181,015.

"'And curiosity here leads us (adds the editor) to review our own work, extending back, say, twenty years, or to 1857, a period during which 170,745 patents have been issued. We find, by actual count, that 62,062 applications have been made through the Scientific American Patent Agency for patents in the United States and abroad. This averages almost ten applications per day, Sundays excluded, over the entire period, and bears the relation of more than one quarter to the total number of patents issued in this country up to the time of writing.'"—*Philadelphia Evening Bulletin.*

© 1877 SCIENTIFIC AMERICAN, INC.

PRACTICAL MECHANISM.

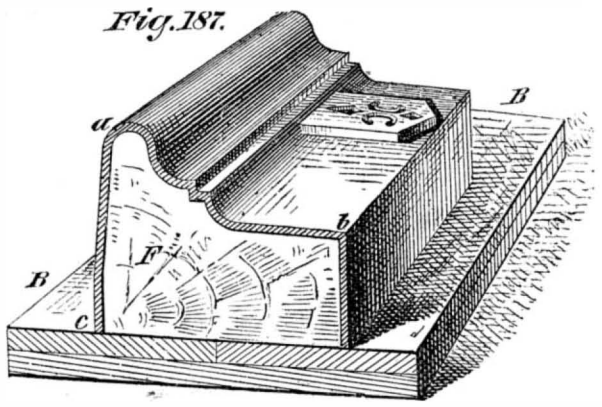
BY JOSHUA ROSE.

NEW SERIES—NO. XXV.

PATTERN MAKING.—THIN WORK.

In the examples we have hitherto presented to the reader, we have supposed the pattern to be of such substance or thickness as to be able to bear the pressure of the sand being rammed about it in moulding without breaking or altering its form; but this is not always the case. The parts of a stove, for instance, are cast often less than $\frac{1}{8}$ inch in thickness; the same may be said of most of the ornamental iron-work used in architecture, and even cornices and window sills range only about $\frac{3}{16}$ or a $\frac{1}{4}$ inch thick. It is true that for this kind of work metal patterns are almost invariably used; but for the pattern maker this is indifferent, as wood patterns have to be made from which the metal patterns are to be cast. Take, for example, the window sill shown in section in Fig. 187; to enable it to withstand the pressure of the sand while ramming, we must fill the interior with a

Fig. 187.



form or block, shown at F, which is to be used in conjunction with the board, B. This form and board are no less useful to the pattern maker than to the moulder; for let the form be once obtained of the proper size and shape, and the construction of the pattern is so far simplified as to be merely a covering of this form with wood slightly thinner than the required thickness of metal. Most thin work is made in this manner, especially if the patterns are of such size or shape as to need the joining together of many pieces; it is not the pattern itself that demands our first attention, but rather the form that supports it.

Thin work demands great care and patience on account of its fragile nature. Scarcely any hold can be obtained for nails; and though the best glue is used, it cannot always be relied upon. Dovetails for square corners, if they are end wood to end wood, will be found very superior to glued joints. Furthermore, as few joints should be made as possible, and the pattern should be well protected by several coats of varnish. In working out thin mouldings, as for instance, the portion of the sill from *a* to *b*, which should be of one piece, we plane up a piece of a suitable width and thickness, and trace the outline of the moulding upon each end of the piece; then, as it lies flat upon the bench, we work out on one side to the lines which will fit the form, as in Fig. 188, and then, by temporarily fastening the piece to the form, F, to give it proper support, we are enabled to work out the opposite side to the required shape. In working out thin mouldings, a circular saw with an adjustable table will be of great assistance, as by its means we may make a series of saw cuts so close together as practically to take out half the stuff, and form an excellent guide for cutting away the other half (see Fig. 188). The part from *a* to *c*, Fig. 187, should not be formed by glueing thin stuff together at the obtuse angle, but should be of one piece. Fig. 189 is a section of a cornice lying upon its bed or follower board, B; it may be made of one piece, as in the previous example.

Fig. 188.

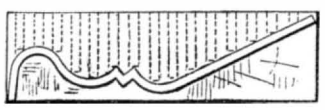
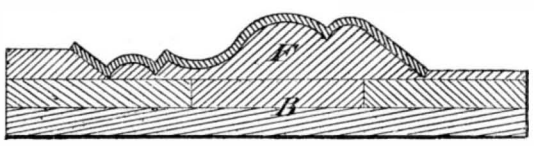
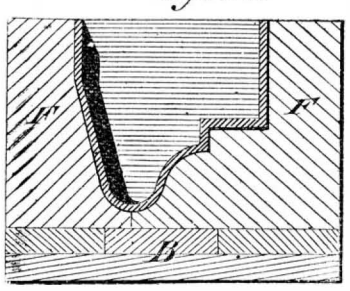


Fig. 189.



In moulding work of this kind, the procedure is as follows: The board, B, with the form and pattern, is placed upon a level bed of sand so that it may not wind or twist under the weight that is to be put upon it, which will consist of the nowel rammed full of sand. The board and nowel are fastened together by cramps, and, the ramming finished, the whole is turned over; the board and form are then removed. There is no longer any necessity for the support of the latter, as the sand, having been once rammed, does not press upon the pattern to its injury, but keeps its position and becomes a good and sufficient support to it during the ramming up of the cope, which is now placed in position, and the moulding continued in the usual manner. Instead of the form, F, which fills the interior of the pattern, we may provide a strong enveloping form, as shown in Fig. 190; the difference is that the reverse side of the casting will be uppermost as compared with the other case. The form must fit that side of the pattern which we wish to come next the cope. Forms of an irregular or difficult shape are often advantageously made by simply pouring plaster of Paris into the patterns for which they are intended. A great deal of thin work is formed by dry sand coring, often from necessity; but when practicable, the dry sand core is discarded and the pattern made to leave its own core. This insures greater accuracy, is cheaper, and causes the interior surface of the casting to be the same as the exterior. When dry sand cores are employed, there is no difference between thin work and thick, and therefore the methods described in former pages are a sufficient explanation of the process.

Fig. 190.



Duties of an Engineer in the Care and Management of a Steam Boiler.

The following instructions may be of little importance to skilled engineers, as such are supposed to be thoroughly versed in all the matters discussed; but to young and less experienced engineers, we believe that the directions, from the Indianapolis *Mechanical Journal*, will be found useful.

The first duty of an engineer when he takes charge of an engine and boiler is to examine his boiler and see that the water is at the proper level. The water should be kept up to the second gauge whilst working, and up to the third at night. The reason why the water should be raised at night is to prevent it from becoming too low from leakage or evaporation. In case the water should become dangerously low, the engineer should immediately draw the fire and allow the boiler to cool, and not admit any cold water to the boiler or attempt to raise the safety valve, as it would be positively dangerous. The reason why it would be dangerous is, that it would lessen the pressure in allowing the steam to escape from the boiler, thus allowing the water to rise up and come in contact with the overheated iron, and probably cause an explosion. In case the water supply should be cut off from the boiler for a short time, he should cover his fire with fresh fuel, stop his engine, and keep the regular quantity of water in the boiler until the accident is repaired and the water supply renewed. To get up steam, the engineer should first see that the water is at the proper level; he should then remove all ashes and cinders from the furnace, and cover the grate with a thin layer of coal; and after placing his wood and shavings on the coal he will be ready to start his fire. The advantage in placing a covering of coal on the grate before the wood or shavings is that it is a saving of fuel, as the heat that would be transmitted to the bars is absorbed by the coal, and the bars are also protected from the extreme heat of the fresh fire. An engineer should allow his fire to burn gradually when commencing to get up steam from cold water, as by allowing the fuel to burn very rapidly some parts of the boiler become expanded to their utmost limits, while other parts are nearly cold. Of course, a great deal depends upon the time in which he has to raise his steam. An engineer should regulate his fire at a uniform thickness, and not allow any bare places or accumulations of ashes or dead coals in the corners of the furnace, as these places admit great quantities of cold air into the furnace, and render the combustion very imperfect. An engineer should avoid excessive firing as much as possible, as it is attended with more or less danger, because the intense heat repels the water from the surface of the iron and allows the boiler to be burned. He should keep about three inches of anthracite coal and about five inches of soft coal on his fires, but he should regulate the thickness of the fire according to the capacity of the boiler. If the boiler is too small for the engine the fire should be kept thin, the coal supplied in small quantities and distributed evenly over the grate, and the grate kept as free as possible from ashes and cinders; but if the boiler is extra large for the engine, the thickness of the fire makes but little difference. If the fire becomes very low, he should neither poke nor disturb it, as that would have a tendency to put it entirely out; but he should place shavings, sawdust, wood or greasy waste on the bare places, with a thin covering of coal; then, by opening the draught to its full extent, the fire will soon come up. If it should become necessary to burn wood on a coal fire, it is always best to make an opening through the coal to the grate bars, so that the air from the bottom of the furnace can act directly on the wood and increase the combustion. He should give great attention to the regulation of the draught in the furnace, as it is one of the most important parts of an engineer's duties, for in fact it is next in importance to the regulation of the water in the boiler.

It is well known that immense quantities of fuel are recklessly wasted by ignorance and carelessness in the management of the draught. He should not have any more draught at any time than would produce a sufficient combustion of the fuel to keep the steam at the working pressure, as by opening the damper to its utmost limits great quantities of heat are carried into the chimney and lost. An engineer cannot carry out this plan in all cases—only in furnaces and boilers that are sufficiently large to furnish the necessary amount of steam without forcing.

Of course, where the boiler is too small for the engine, or has not sufficient heating surface, it is impossible to economize fuel. In some cases it is a good plan to throw a jet of steam under the furnace bars when the draught is insufficient to produce the necessary combustion of the fuel. It is considered an advantage, before clearing a fire, to throw some water under the grate bars, as the oxygen of the steam thus generated under the furnace will unite with the oxygen of the atmosphere, and insure a more rapid combustion of the fuel after the fire is cleaned.

Steam or water should not be thrown under the grate bars of locomotive boilers when such boilers are used for stationary engines, as steam or water in the ash-pit forms a lye with the ashes, and corrodes the iron and destroys the water legs of the boiler. An engineer should always keep his pit clean, as by allowing the ash pit to become filled with ashes and cinders the air becomes heated to a high temperature before entering the fire, which naturally interferes with the combustion of the fuel. The grate bars also become overheated, and in many cases badly warped or melted down. He should at all times watch his safety valve carefully, and keep it in good working order. He should do this at least once a day; the morning is the proper time, and then he will feel safe during the day. We have often seen safety valves with all kinds of weights on them, and it at once gave us a poor opinion of the engineer. No first-class engineer will do this. It should be one of the main reasons for discharging him. In blowing out a boiler, remove all fire from the furnace, and see that the steam is at the proper pressure—say from 45 to 50 lbs. Always close the damper.

At least one hour should pass between drawing the fire and blowing out the boiler. This will allow the furnace to cool and prevent the boiler from being injured with the heat after the water is all blown out. The higher the steam pressure, the higher the temperature of the iron, so that by blowing out the boiler under a high steam pressure the change is so sudden that it has a tendency to contract and cause the boiler to leak. The boiler should not be filled with cold water immediately after blowing out, as the introduction of cold water into the boiler before the temperature of the iron becomes lower would, in all probability, cause the boiler to leak. The boiler should be blown out whenever any appearance of mud is found in the water. When fresh water is boiled, it is supposed to deposit its mineral, and after that it is not advisable to blow out the pure water and fill the boiler with water holding matter in solution and suspension; and for this reason once in two or three weeks is often enough to blow out the boiler. When filling the boiler, some cock or valve in the steam room should be opened and allow the air to escape. If not, the air would retard the ingress of the water, and also collect in the steam-room of the boiler, and prevent the regular expansion of iron when the fire is started.

The steam-room in a boiler is that portion of the boiler occupied by steam above the water. The water room is that portion of the boiler occupied by water. The fire line of the boiler is a longitudinal line above which the fire cannot rise, on account of the masonry by which the boiler is surrounded. The tubes of a boiler should be cleaned at least once a week; all ashes and soot should also be removed from the outside of the boiler. This all makes a great saving in fuel, as it allows the fire to act directly on the iron. Boilers should be cleaned at least once in three months. All stays, braces, seams, and angles of the boiler should be examined carefully. He should also sound the shell of the boiler with a very light steel hammer. It is a good way to determine the condition of the iron.

The steam guage should he tested at least once a year. It should be done by a test-gauge, made expressly for the purpose. The water gauge should be kept clean, inside and out, and all points belonging to same. By opening the drip cock and closing the water valve and allowing the steam to rush down the glass, the steam will carry out the mud and sediment. They should also be swabbed out with a piece of cloth or waste on a small stick when the boiler is cold; but care should be taken not to touch the inside of the glass with wire or iron, as an abrasion will immediately take place.

Decay of Timber.

Wet and dry rots are the two forms of decay which attack timber that is exposed to the action of the weather, and the cause of both may be said to be heat with moisture. Confined air and evaporation cause dry rot, and imperfect evaporation wet rot to a greater or less degree.

Investigation shows that as a preventive against these rots the timber should be well seasoned, and if used where liable to be under the influence of sun and rain should be well well painted, or, if not painted, should be impregnated with linseed or oil of tar. The best preventive, however, is found to be that of allowing a free circulation of air around the timbers, and the walls to be allowed to dry thoroughly before the introduction of the timbers; should the timbers have taken either of these rots very little can be done to preserve them. In case the rot is perceived to be at the end of beams only—where in fact it generally commences—the best method of preserving the rest of the timbers is to effectually cut away the decayed portion and scarf with sound; if, however, this should not be practicable, the wood may be scraped and cleaned of all fungus or extraneous matter and then impregnated with any of the usual oils.—*Cincinnati Trade List.*

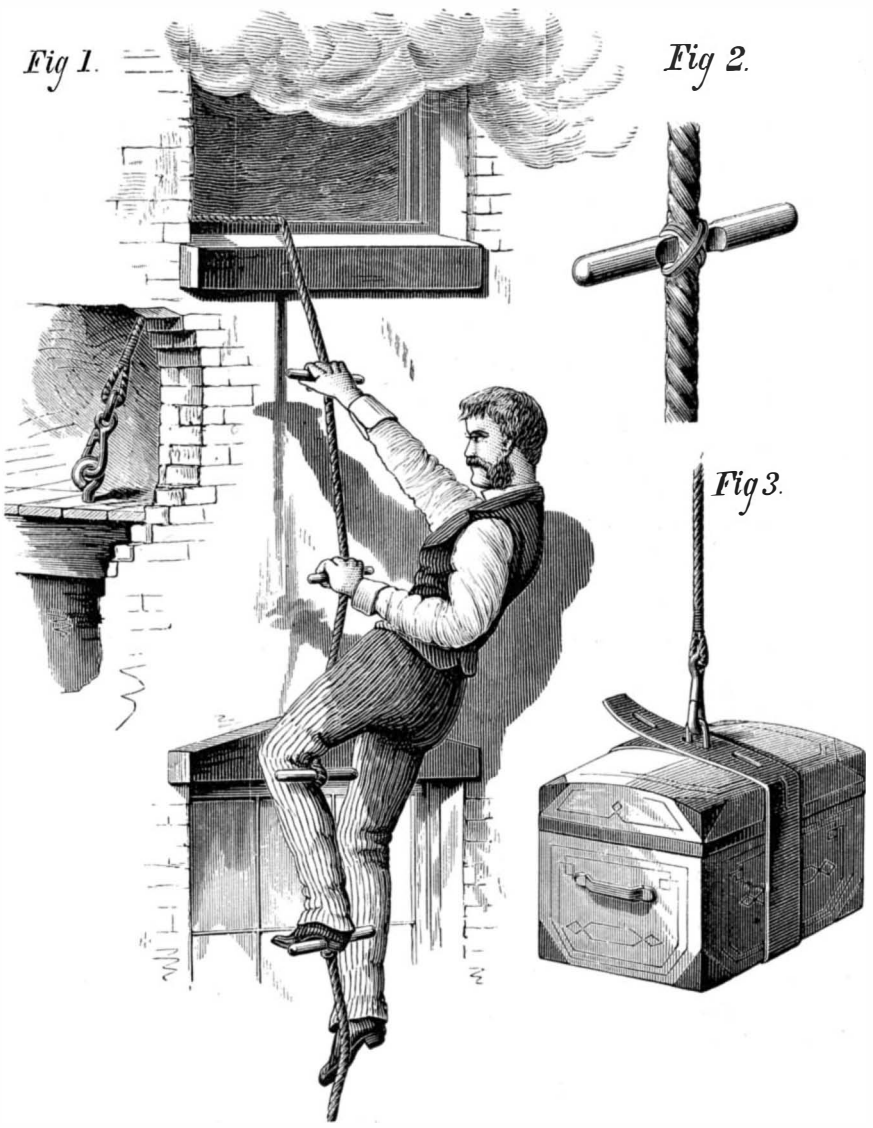
© 1877 SCIENTIFIC AMERICAN, INC.

IMPROVED FIRE ESCAPE.

We noted last week the necessity existing for some simple and efficient fire escape, which could be rolled in small compass so as to be conveniently stowed in the traveler's satchel or trunk. The invention illustrated in the annexed engravings aims to supply this need. It consists of about a hundred feet or less of wire rope, one end of which is turned up to form a loop which is secured by wire seizings. In this loop, which is lined with leather to prevent chafing, a spring hook is secured. Along the rope, crossbars or rests are lashed with wire, at intervals of about 15 inches. These bars are of iron, having a portion of their surface flattened near the centers on one or both sides, and are inserted through the strands of the rope (Fig. 2).

The apparatus can be very quickly got ready for use, as it is only requisite to screw an eye into the woodwork or flooring of the room, attach the snap hook, and lower the escape out of the window, whence it forms a ladder, Fig. 1. The inventor also provides a strap, Fig. 3, which carries a staple to which, after the strap is passed around a trunk, the end of the fire escape rope is attached. The trunk is thus easily lowered; and after reaching the ground, it serves as a means of steadying the ladder. By the same means, women, children, or invalids may be lowered from windows.

Patented through the Scientific American Patent Agency, October 24, 1876. For further particulars, address the inventor, Mr. H. R. Houghton, West 42d street, New York city.



Age of Labor-Saving Appliances.

The *Manufacturing and Trade Review* thinks that the greatest reason why there is such an over-proportionate abundance of all kinds of products as compared with former times, and comparatively so few workmen are employed, is that these products are the results of mechanical appliances, one of which does the labor of numbers of workmen. Instead of hoes and spades, and sickles, and scythes, and flails, the cultivators, planters, reapers, and mowers, and thrashers are used. So with the production of the nail, horseshoe, cutlery, tools, clothing; in fact, what is not made by machines for the purpose is very far behind the age. The business of the world now is inventing, improving, and running machinery and appliances to make machinery and tools, and in producing the articles they make; and the aim of the present workman must be to thoroughly know the use and care of machinery, the strength and adaptability of materials for the manufacture of appliances. If the world seems to be already supplied with all these, then his business is to possess the machine or appliance and use it in producing the thing which his taste and judgment may suggest. It is useless to resist this march of machinery. Only the man who accepts, adopts, and enters most heartily into its use and product, will keep abreast of the present progress.

IMPROVED CALCULATING MACHINE.

The drudgery of mental computation, of all labor, is perhaps the most enervating and uninteresting; and an effectual device to remove or even lessen the mental effort will be readily appreciated by mathematicians, engineers, bankers, actuaries, and accountants.

The calculating machine, properly so called, must not be confounded with the simple slide rules, adding machines of various kinds, interest tables, and other devices called by the same name. This instrument is a piece of mechanism that performs its task in a direct and complete manner, taking in a great range of work, and using and giving numbers at full length and in plain figures.

The construction and operation of the apparatus as illustrated herewith are both simple. There is an upper cylinder, which is turned by the crank, and which itself drives a smaller shaft underneath. A slide, that can be set in eight different positions on the cylinder, carries eight figured rings that can be set to represent any number of eight or less decimal places. Each turn of the crank adds the number set up on the rings to the number represented on the ten recording wheels carried by the lower shaft. The multiplication process will best be understood by an example. To multiply 347 by 492, the three upper rings are set at 3, 4, and 7, respectively. The cylinder is then turned twice to multiply by the units figure of the multiplier. If now the slide is carried along one notch, where each ring will act on the next higher recording wheel, and turned 9 times, 347 will be multiplied by 90, and the product at the same time will be added to the product already scored. Another shift of the slide and four turns will complete the operation, and show the result, 170724=(347×2)+(347×90)+(347×400) upon the recording wheels. A half turn of the crank backwards erases this result, bringing all the wheels to 0, ready for the next operation.

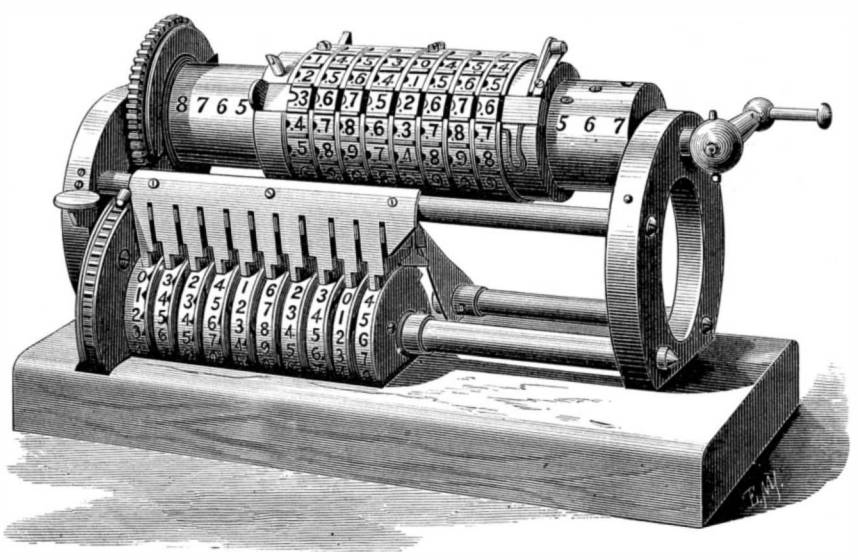
Division is the reverse of multiplication. The dividend is set up on the wheels, the divisor on the rings, and the quotient records itself on the upper recording wheels. The machine of the size illustrated will use numbers of eight or less figures, and show the result in full, if not over ten figures, and its upper figures if more than ten places are necessary.

The dimensions of the instrument are 13×5×7 inches, and

HOUGHTON'S FIRE ESCAPE.

it contains but eighty working pieces of mechanism, none of them small or delicate. Made mostly of brass and iron, its smaller parts are of steel, portions of which are tempered. Its results are shown in plain figures, stamped on unpolished silver-plated surfaces and filled in black. All prominent parts are nickel-plated and polished.

The machine was invented in 1870, but was not manufactured for general use until this year. It was introduced to the public for the first time at the Centennial Exhibition; and the official report, signed by such well known men as President Barnard, of Columbia College, Professor Hilgard,



NEW CALCULATING MACHINE.

of the United States Coast Survey, Professor Joseph Henry, Professor J. C. Watson, and Sir William Thomson, says: "It is simple in construction, not liable to get out of order, its use greatly saves the mental labor of computation, and lessens the liability to error. It is deemed superior to all other instruments of its class yet produced." Other well known experts state that a saving in time of more than sixty per cent is effected over ordinary methods.

Upon work of four or five decimal places, the machine is claimed to have an advantage of three to one over common logarithms; and it is quicker and easier to use natural numbers and natural sizes, tangents, etc., on the machine than to use the common logarithmic method.

The patentee and manufacturer is George B. Grant, 94 Beverly street, Boston, Mass. He will supply any further information.

New Theory of the Origin of Petroleum.

The origin of the immense quantities of hydrocarbon oils which are found saturating strata of sandstones, or pent up in cavities of the older rocks, or escaping to the surface and collecting upon pools of water, has been the subject of frequent discussion. The theory generally accepted, and endorsed by such names as Hunt, Newberry, and Silliman, is that it is of organic origin, either vegetable or mineral. It has even been suggested that the bad smelling petroleum of Canada owes its origin to decayed fish. According to T. Sterry Hunt (*American Journal of Science*, March, 1863), "the pyroschists of Bosanquet belong to the Devonian series, and contain the remains of land plants, so that a partially decayed vegetation may be supposed to have been the source of the organic matter which is intimately mingled with the earthy base of the rocks; * * * but in the pyroschists of the Utica formation, the chief organic remains to be detected are graptolites, with a few brachiopods and crustaceans."

In view of these facts we are not a little surprised at the new and yet plausible theory advanced by the distinguished Russian chemist, Mendelejeff, before a meeting of the Chemical Society of St. Petersburg. The appearance of oil on the surface of the earth proves that it has a tendency to rise through the various strata of the earth, and this is no doubt due to its being lighter than water, which, being everywhere present, forces it upward. For this reason we are compelled to suppose that it was formed lower down in the earth than the places where it is now found. Another reason for this belief is that the sandstones, in which much of this mineral oil is found, contain no charred organized remains, which must be present where the oil was produced, if it be of organic origin. Since petroleum is found in the Caucasus in tertiary, and in Pennsylvania in the Devonian and Silurian, its origin must have been in the older rocks at a still greater depth. But in those ancient periods, like the Silurian, not many organized beings could have existed. Hence Mendelejeff thinks that it is very improbable that petroleum is the product of any decomposed organic matter.

Mendelejeff starts with Laplace's theory of the formation of the earth, applies Dalton's law to the original gaseous condition of the constituents of the earth, and calculates the probable arrangement of the metals in the earth from the density of the globe and the vapor density of the elements. Starting with the assumption, which is not improbable, that iron is the most abundant of metals, since it is present in large quantities in the sun and in meteorites, and admitting the existence of carbon compounds of this metal, not only will it be easy to explain the formation of petroleum, but one can understand all the peculiarities of its occurrence in those places where the earth's strata has been broken by the elevation of mountain chains. Breaks made in this way permitted the water to permeate to the carbonaceous metals; and at the high temperature, and under heavy pressure, it acted upon them, forming oxides of the metals and saturated hydrocarbons. The latter rose as vapors to the higher strata, where they were condensed, saturating the porous sandstones, which are capable of absorbing many oily products.

Many other phenomena of nature are explained by this theory of the formation of petroleum, such as predominance on the earth's surface of elements with small atomic weights, the occurrence of oil in straight lines or arcs of huge circles, its dependence upon volcanic action, which has been noticed by Abich and others, the magnetism of the earth, and many other natural phenomena.

Salicylic Acid.

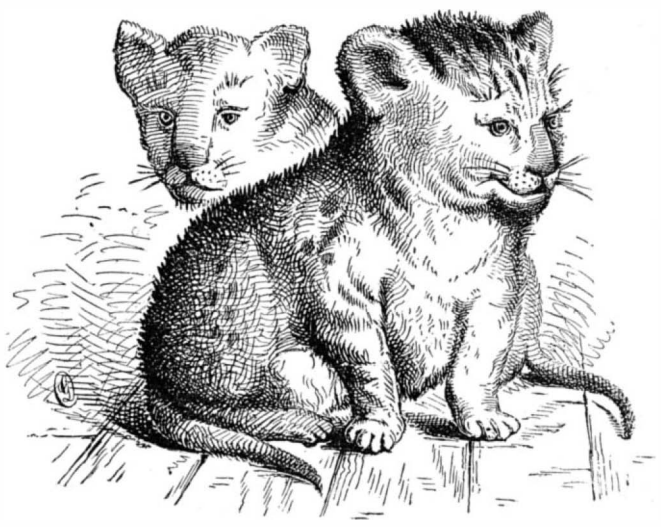
M. Blandeau, of Paris, states that, according to dentists, this agent has injurious effects on the teeth. English observers have noticed its effect on the bones, and necrosis of the tibia has been assigned to its use. It evidently possesses considerable affinity for the calcareous salts of bone, and we see the urine loaded with lime salts in an ultra-physiological proportion, from the internal use of the acid. The salicylate of soda presents the same dangers; and too much caution cannot be taken in the use of any salicylic preparation.

© 1877 SCIENTIFIC AMERICAN, INC.

BABY BRUTES.

The Central Park menagerie, or rather Mr. P. T. Barnum, who is the proprietor of most of the animals exhibited free to the public during the winter, has recently become possessed of a litter of panthers, two lions, a baboon, and a dromedary, all born in the cages. Of the baby lions and panthers, engravings are given herewith. The lions are now nearly four months old, and are about as tall as a moderate-sized terrier dog. They are exceedingly fat, and, like all young of their species, are covered with a short downy fur, profusely mottled. They possess, in brief, all the characteristics of kittens, except gracefulness of motion; for they are the personification of clumsiness. Their legs are thick, short, and bent, their paws, which already possess formidable claws, appear too large, and their bodies are long and ungainly. The temper of the infants, despite their innocent and childlike expression, is none of the best; for they show ranges of white sharp teeth, and spit viciously on any stranger approaching their cage. The cubs are of especial interest to zoölogists from the fact of their being the offspring of a cross between the Asiatic and African species of lions. This mingling of breed has not before been attempted, and the characteristics of the young will be carefully watched.

The panthers are of the ordinary variety, peculiar to this country. As is the case with most untamable brutes, they breed unfrequently in captivity. The cubs are of the same age as the young lions; and were it not for their peculiar markings, resembling closely those of some species of young deer, they might well be mistaken for good sized cats. Their behavior, when stirred up, is a ludicrous mixture of fear, curiosity, and defiance. A slight poke from the end of a cane causes the cub touched to beat a speedy retreat toward the mother; then it turns and watches the stick with intense interest, relieving its feelings by an occasional spit. Finally one paw flies forward, and a spiteful dig is administered, and then another retreat takes place. This is continued as long as the intruding object remains in the cage.



YOUNG LIONS IN CENTRAL PARK, NEW YORK.

It is curious to notice, both in the lioness and in the panther, that peculiar pride in showing their offspring which the domestic cat manifests in the most unmistakable manner. It seemed also as if the old animals regarded raps on the bars of the cage, or the introduction of canes to induce their progeny to take better attitudes for sketching purposes, in the light of grateful attentions; as, no matter how much the young ones spit and scratched, the mothers never showed the slightest resentment, but quietly crouched and stared at the interloper in abstracted calmness. The writer saw the lioness deliberately wake up her cubs, who were cuddled into an undistinguishable ball of fur, and spread them apart with a blow of her paw, for no reason that could be divined other than that she wished to display them. They manifested no hunger, but sat up, as they are shown in our engraving, and blinked like suddenly awakened babies, until their eyes became accustomed to the light.

Plating of Iron and Steel with Nickel and Cobalt by Immersion.

Mr. F. Stolba—in a German periodical which we should be glad to give credit to, if there were not six words and fifty-seven letters (including forty-two consonants) in its name—proposes the following simple process for nickel-plating polished iron and steel articles. To a dilute solution (5 to 10 per cent) of as pure chloride of zinc as possible, there is added enough sulphate of nickel to color it strongly green. This is heated to ebullition in a porcelain vessel. The objects, being completely cleaned of grease, are then suspended in the liquid so that they touch each other as little as may be; and the boiling is kept up for from half an hour to an hour, water being from time to time added in place of that evaporated. The nickel is precipitated in a brilliant white layer wherever the surface of the object is not greasy or rusty. The operation can be continued for several hours if desired; but the plating will not thus be rendered much thicker.

After removing the objects, they are washed with water holding chalk in suspension, and carefully dried. They may afterward be cleaned with chalk, and they take a fine yellowish-toned polish. The chloride of zinc used should contain no metal precipitable by iron. When it cannot be obtained of sufficient purity, it may be made by dissolving zinc scraps in hydrochloric acid, and allowing the solution, containing an excess of metallic zinc, to rest, in order that the metals precipitable by the zinc may separate. Filter at the end of 24 hours, and the solution is ready for use; each portion of zinc dissolved corresponds to about 2·1 parts of chloride of zinc.

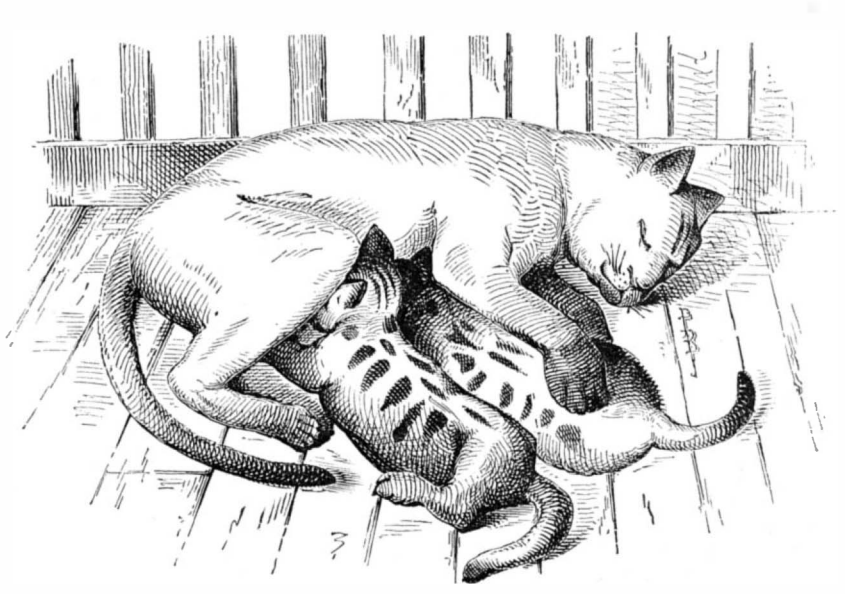
The sulphate of nickel should also be as pure as possible, and the cold solution should not precipitate when a plate of iron is plunged in it, as would happen, for example, if it contained copper. When during the operation the liquor becomes a pale green, owing to the precipitation of nickel, more sulphate must be added until the intense green is regained. When the used liquid is exposed to the action of the air, it deposits hydrated oxide of iron, coming from the dissolved metal. It should be filtered, and more chloride of zinc and sulphate added, when it may be again used.

In the same way, polished iron and steel objects may be covered with a brilliant plating of cobalt, by using a sulphate of cobalt solution. The appearance of this plating differs little from that of polished steel. The distinguishing characteristic is the light rose-colored tint. The author states that the plating wears well.

A New Class of Blowpipe Reagents.

Of all methods of analysis, that performed in the dry way by means of the blowpipe deserves the palm on the score of simplicity. The reagents are only four or five in number, the apparatus so small and portable that it can be carried in the breast pocket; and yet in most cases, with a little skill, the results are quite as satisfactory as those obtained in a completely equipped laboratory. There are, however, some cases, unfortunately but few, where the blowpipe reactions are not as simple as might be desired: such are those with boron and the iodides; but Messrs. Ihles and Devereux recently have overcome these. One necessity of every blowpipe set has always been a bottle of strong mineral acid for decomposing carbonates, detecting limestones, etc. On a journey, as at all times, acids are unsafe companions in pocket or portmanteau. A recent discovery of Dr. H. Carrington Bolton helps us over this quicksand, and enables the analyst to dispense with liquids entirely. The new departure (which is original, we believe, with Dr. Bolton) consists in the use of dry crystalline organic acids, such as tartaric, citric, and oxalic. When required for use, a few crystals are thrown into water; the mineral to be tested, which must be in a very fine powder, is introduced; and then, with or without heat, as the case may be, solution is accomplished. The facility with which the mineral dissolves in one or the other acids aids to determine its name. Even sulphides and silicates may, in several cases, be brought into solution by organic acids; and when the acid alone fails, it can be mixed with saltpeter (potassic nitrate) and the mineral thus decomposed.

A new field of very wide extent and unlimited interest opens here, and we hope Dr. Bolton will explore it to its furthest boundaries. Perhaps a new kind of analysis will be developed, to which we would give the term organo-wetish-dry testing.



PANTHER AND HER YOUNG, CENTRAL PARK, NEW YORK.

SOMEBODY has perpetrated the following on Captain Eads' work on the Mississippi: "Those willow mattresses at the mouth of the Mississippi make the bed of the river more comfortable, to be sure. But still the shipping don't lie there nearly as long as formerly. If they are bound to New Orleans, they 'get up' as soon as possible."

ZINC, it is said, may be purified by precipitating its sulphate with an alkali, mixing the oxide thus produced with powdered charcoal, and exposing the mixture to a red heat in a covered crucible.

Dangers from the Dead.

That the dead should kill the living seems a paradox; yet nothing is more true. Indeed, we venture to say that every year, in our land, corpses murder more people than assassins do. Not only have intramural interments poisoned whole blocks and quarters, not only has drinking water contaminated by graveyards yearly spread disease and death through country hamlets, but, before the process of decomposition commences, there is often a great and pressing danger from infectious disease. We quote a recent instance:

"Dr. Goldie, the Medical Officer of Health for Leeds, England, in his report to the local authority, states that every one of thirty people who attended the wake of an Irish girl, who recently died in that town from typhus fever, were attacked by the same disease, and no fewer than nine of the cases ended fatally."

So strongly have the needless dangers of exposure at funerals impressed the medical mind, that the Health Board of New York have now issued a circular recommending that no public or church funerals should be given to persons dying of either diphtheria, scarlet fever, measles, or whooping cough.

In Chicago, also, where scarlet fever and diphtheria have been severe this past winter, the recommendation of one hundred medical men in council was in these words:

"There should be no public funerals of any patient who has died of any infectious or contagious disease. Remember that the separation of the sick person from the well is the most certain means of preventing the spread of the disease."

A writer in the Baltimore *Physician and Surgeon*, last December, went so far as to advocate the passage of a law on the subject (the average American man looking upon a "law" as the cure-all on every occasion). He thought it should embody the following provisions:

1. Whenever any one dies of contagious disease, the publication announcing the death should state the cause of death.

2. No person except the immediate family should be permitted to attend the funeral, and the handling and burying the body should be intrusted to persons who devote themselves to that business.

3. A sufficient number of carriages should be kept for the special purpose of attending these funerals, and the hiring them for other purposes should be prohibited, under the severest penalties.

These are good suggestions, but people should learn and obey them out of a natural sense of sanitary propriety, not out of obligation to a statute.—*Medical and Surgical Reporter.*

On Vegetarianism.

A discussion on this subject took place at a recent meeting of the Medical Society of London. True vegetarians, it was urged, eat neither butter, eggs, nor milk.

Sir Joseph Fayrer related his experience of the effects of this diet among the natives of India, and said he had no doubt that people could live on vegetables alone. He had seen some of the finest specimens of the human race, as regards strength, power of endurance, and physical development, among the inhabitants of the northwest provinces of India, who were pure vegetarians; but he accounted for their condition from the fact that their food consisted chiefly of leguminous seeds, such as peas, beans, and the like, which contained a larger amount of nitrogen than other vegetables.

The President, Dr. Buchanan, remarked that in the discussion several factors should enter—as age, which was a considerable element, as no doubt people advanced in years appear to thrive on a vegetable diet, whereas children require almost a pure animal diet. Again, climate was a great factor; and in the treatment of disease it could be strongly advocated; while, lastly and chiefly, temperance must be strictly enforced, avoiding excess in the use of animal food, and taking, in fact, a middle course.

A Torpedo that Travels 275 Miles an Hour.

The most terrible invention for warfare that has ever been devised—if we may trust the reports of our English contemporaries—has recently been submitted to the Admiralty by a clergyman, the Rev. C. M. Ramus. The Whitehead fish torpedo has already proved its capability of travelling beneath the surface of the sea at the rate of 20 miles per hour; but the "rocket float," as the new machine is called, weighs 50 tons, and is propelled on the surface at the rate of 275 miles per hour for a distance of four miles. The apparatus is a timber or iron vessel, the bottom of which is a series of inclined planes. In the head is the explosive, and enough gun cotton can be carried to blow up the largest ironclad in existence, while the rocket, by the combustion of which the craft is impelled, is laid along the deck. The vessel is said to be easily guided by a rudder of very thin sheet metal.

If the coming British experiments substantiate the foregoing, it would seem that armor-plated ships have had their day, and that the naval vessel of the future should be of cork.

© 1877 SCIENTIFIC AMERICAN, INC.

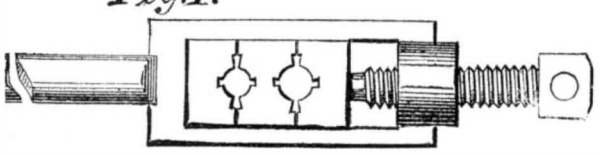
[For the Scientific American.]

A CURIOUS PIECE OF MECHANICAL MANIPULATION.—CUTTING RIGHT OR LEFT HAND THREADS WITH RIGHT HAND DIES.

If there were any one mechanical operation that it would seem the height of absurdity to attempt to accomplish, it would appear to be that of cutting a triple left hand thread with an ordinary pair of right hand dies; but it has been done, and, indeed, is very easy of accomplishment.

A short time since Mr. J. J. Bingley, Master Mechanic of the Hanover Branch Railroad, wrote to me, saying that a workman in Hanover, Pa., had accidentally cut a *treble* left hand thread with a pair of right hand *single thread* dies, and requested a solution of the mystery. Upon request, Mr.

Fig. 1.



Bingley forwarded both the screw and the dies, and the mystery was readily solved, resolving itself into a mechanical operation which may in many cases be turned to excellent account. In Fig. 1 are shown the dies, and in Fig. 2 are a single right hand and a treble left hand thread cut with them. The machinist who cut the first treble left hand thread did so from a combination of manipulative errors, each one of which was necessary to his accidental discovery. First, the dies with which he operated were of a wrong shape, and secondly, the iron upon which he cut the thread was larger in diameter than such a pair of dies should be applied to; thirdly, he wound the dies the wrong way; fourthly, he put a pressure upon them in a direction wrong with relation to the direction in which the dies were wound upon the work.

Fig. 2.

Referring to the first point: Dies for use in hand stocks, that is to say, adjustable dies that are made in two pieces, and are intended to pass more than once along a thread before finishing it, should be, and are almost universally, cut with a hub or master tap larger in diameter than the bolt they are intended to cut threads upon, for the following reasons: In Fig. 3 is shown a pair of dies tapped with a ¾ inch master tap or hub, and in Fig. 4 is shown the same pair of dies, opened out and placed upon a ¾ inch bolt. Dies made in this manner, it will be observed, when opened out to take the first cut upon the bolt, have nothing to steady them, since only the very corners of the teeth contact with the bolt; and the sides of the thread and the length of the teeth of the die have a great deal of clearance upon the bolt, and the consequence is that they operate very unsteadily until the thread is cut to some depth upon the bolt. The edges of the teeth, at A and B, perform all the cutting duty; and as the thread approaches completion upon the bolt, the friction becomes very great unless the dies are given clearance in the thread. It is usual, therefore, to cut such dies with a master tap of larger diameter than that of the bolt upon which the dies are intended to operate. How much the excess of the diameter of master tap should be is a disputed question. In some cases an amount equal to twice the depth of the thread is used, and in others once that depth is preferred. The dies shown in Fig. 5 are twice the depth of the thread larger in diameter than the size of the bolt; and as a result, when placed upon the bolt, the teeth fit closely to it, and therefore operate very

Fig. 3.

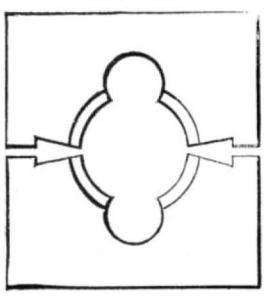


Fig. 4.

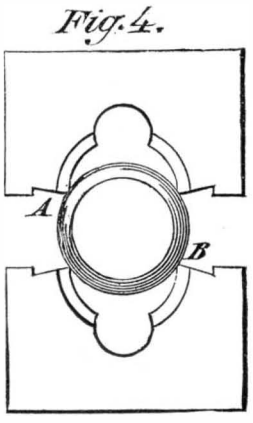
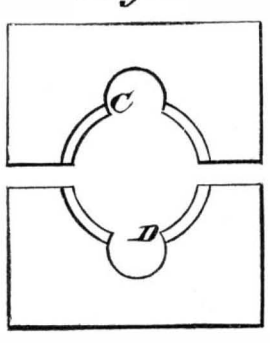


Fig. 5.



steadily, the cutting edges being in this case at C and D. It is obvious that here the dies require to close nearer together than would otherwise be the case; hence a piece of metal equal in thickness to, or rather more than, twice the depth of the thread is placed between the dies while they are being drilled and cut by the master tap. With dies cut in this manner, the sides and length of the teeth fit so closely to the thread, as shown in Fig. 6, as to preclude the possibility of their cutting a thread any different from that of their own teeth, and the cutting edges are well supported by the metal behind them; whereas, in dies cut as shown in Fig. 4, the teeth are very liable to break off, as well as to dull very rapidly. Therefore it is that such dies are wrong in construction. The dies sent to us by Mr. Bingley are of this construction; and it will readily be perceived that, even when applied to bolts of the same diameter as the die itself, the teeth bear upon such fine points, and the back of them is so well clear that, by taking a very fine cut and putting a pressure upon them, they would act as chasers, well canted over; and they would travel in whichever direction the pressure determined. As the die teeth, however, enter the bolt, the sides of the thread would come into play, and would steady and force the dies to cut correct grooves.

These dies are tapped with about ¼ inch taps, and the iron upon which the right and left hand threads are cut is full $\frac{5}{16}$ inch in diameter; and as a consequence, we have the condition of things shown in Fig. 7, in which the very points of the teeth only have contact with the bolt. As a result, the thread may be cut the full depth, without the sides of the thread upon the bolt and those upon the die coming into contact at all. If, then, the dies are placed upon the bolt, and set to take a very light cut, the direction of the up or down pressure placed upon the dies will determine the direction in which the dies will travel and the thread be cut. If the dies are wound from right to left while pressed downwards, the thread cut will be a left hand one, and *vice versa*; and whether the thread so cut will be a single, double, treble, or quadruple one, depends upon the size of the bolt and the amount of the pressure; for though the size of the bolt may afford sufficient clearance to the sides of the die teeth to cut a quadruple thread, yet, if the vertical pressure placed upon the die moves it at the necessary speed, only a double thread will be cut. In other words, the thread cut will be in all cases proportionate to the amount of vertical movement of

Fig. 6.

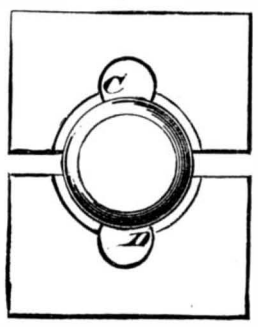
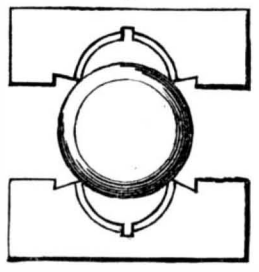


Fig. 7.



the dies. Of five threads cut with the dies shown in Fig. 7, three were treble left hand ones, one was a double left hand, and one a single right hand one. I find as a rule that the thread is apt to be as coarse as the clearance between the threads will permit; and this occurs because of the difficulty of judging the exact amount of vertical pressure necessary to cut any particular pitch. And since the pitch of the thread cut cannot in any event exceed such an amount as will bring the sides of the threads into contact, it becomes easier to cut that extreme pitch than any less one. In cutting the left hand threads, it is necessary to reverse the natural order of things by moving the dies backwards when the pressure is placed forwards, and *vice versa*. By a simple attachment to regulate the vertical motion of the dies when starting, the double or treble threads might be cut with accuracy and certainty.

J. R.

On the Use of Tannic Acid for Testing Potable Waters.

The importance of using pure water, in order to prevent disease and death, cannot be too frequently impressed upon the minds of the public. At all seasons, but more especially in the spring and summer months, persons who use well water are in danger of taking into the system the germs of typhoid and other fevers. These dangerous constituents seldom influence or mar the taste of the water, and are not suspected until they have lain one or more victims on a bed of sickness.

In a recent number of the *Journal für Practische Chemie*, Hermann Kämmerer says, in regard to the reagents employed by chemists for testing potable water, that for the most part they merely show the presence in water of organic matter; but some kinds of organic matter may be present in large quantities without causing epidemics or sporadic diseases. Most methods for the chemical analysis of water do not determine the nature of the organic matter which is dissolved in the water, and, at most, a conclusion is drawn as to the presence or absence of nitrogenous organic matter from the odor emitted on charring the residues left by evaporation of the water. This is very uncertain, because the presence of two kinds of compounds frequently frustrates this distinction, or the presence of a large amount of nitrates prevents the production of the characteristic odor by completely oxidizing the compound.

For hygienic purposes, it is very frequently of the greatest importance to know whether water contains putrefactive matter, especially of animal origin, since the present state of Science points to these as the probable bearers or producers of the real causes of disease. Hence the introduction of reagents which shall enable us to detect animal matter with certainty, and also its approximate quantity, is exceedingly desirable when testing water for hygienic purposes. Kämmerer believes that tannin or tannic acid is a very valuable reagent for this purpose. Tannin is really a group reagent for a large number of bodies of animal origin, which readily suffer decomposition or decay, such as albumen, gelatin, etc. These can easily find their way into the water of the soil, rendering it impure, and, according to our present views, must render such water very dangerous.

Tannin has been recommended before this as a test for water, but has as yet attracted but little attention, although Kämmerer proceeds to prove that it is very excellent for this purpose. He thinks it would be very interesting to prove directly whether putrefactive matter be present in well water which is near enough to receive the drainage of graveyards, factories where glue, blood, and similar substances are used, and in many other cases.

Lefort recently directed attention to the probable presence of gelatin or glue in water from churchyards. In an analysis of water taken from a well at a distance of ten rods from the churchyard of St. Didier, made by him in 1873, he obtained a residue, which, when boiled with hydrochloric acid, and on charring, emitted an odor which he thought could only be produced from glue. Lefort does not seem to have sought or obtained any further reaction characteristic of gelatin.

When analyzing three specimens of well water from a churchyard in St. Leonhard, near Nuremberg, Kämmerer observed a similar reaction of the residues of evaporation, and then tested the water directly by means of tannin. For this purpose 18 cubic inches of the water to be tested was placed in a glass cylinder; to each sample was added 0 18 cubic inch of a freshly prepared, cold, saturated solution of tannin, and left standing in vessels closed and airtight. The first sample instantly became cloudy by the separation of a rapidly increasing, curdling precipitate, which, at the end of an hour, formed a thick gelatinous precipitate, and after standing for days did not settle clear and colorless. The sample from the second well acted in a similar manner; at the end of an hour there was a heavy, gelatinous precipitate, which soon took a gray, then light green, and finally dark green color, due to a trace of iron in the water. The third sample retained its clear appearance a longer time, and in the first four hours only a slight turbidity could be observed, yet in 24 hours a thick starchy precipitate had formed. The organic nature of the precipitate was undoubted, but was further proved by charring it, when it gave off, like the residue from evaporation, a strong odor of burned horn, and left behind a very small amount of ash in proportion to its volume. For the purpose of testing for volatile organic acids, sulphuric acid was added to a few quarts of each sample of water, which was then distilled off to one fifth its original volume; a very small quantity of the tannin solution added to the residue caused an immediate coagulation to a stiff jelly also in the residue of the water from the third well, which, when treated directly with tannin, was not entirely precipitated for 24 hours. Since sulphuric acid precipitates tannin from its aqueous solution, and this precipitation looks milky and is difficult to clarify, it was thought possible that the strong reaction in these residues might be referred to the precipitation of the tannin by the sulphuric acid. But this supposition did not agree very well with the volume of the precipitate, which seemed disproportionately larger than the quantity of tannin employed. Comparative experiments were made with tannin precipitated by sulphuric acid, and gelatin precipitated by tannin, and showed that, on heating, the tannin dissolved in the sulphuric acid and water before it reached the boiling temperature, and, on cooling, was precipitated again and soon settled, leaving the liquid clear. The precipitate formed by tannin in a solution of gelatin is not dissolved by dilute sulphuric acid even when boiling, but seems rather to increase. The precipitate formed by tannin in the residues from distillation reacted precisely like the latter; on heating to boiling, they seemed rather to increase than to diminish.

After he had found, by further experiment, that the turbidity produced by tannin solution in the three samples of water were not caused by albumen, but by gelatin, Kämmerer feels that he is justified in drawing the following conclusions:

1. There can no longer be any doubt of the presence of gelatin in well water. In some cases it is found in comparatively large quantities.

2. Tannin is a suitable reagent for detecting this and similar substances, and this test ought never to be omitted in analyses of water for hygienic purposes.

3. The presence of salts and other compounds found in water may retard the precipitation by tannin. To judge of the purity of water from the tannin reaction, it must stand at least 24 hours.

4. Every water that suffers considerable turbidity with tannin must be held to be dangerous for drinking. It seems to make no difference whether the precipitate falls at once or only after some time, as the time depends less on the substance to be precipitated than on the other substances dissolved in the water which retard the precipitation.

Bichromate of Potash an Antiseptic.

M. Langeroy states that one per cent of bichromate of potash in water will prevent putrefaction in animal and vegetable substances immersed therein. Meat, after being kept in the solution for several months, becomes like gutta percha, and the author has struck medals from pieces of it. It is no longer eatable, however, and it is even said that dogs refuse to touch it.

© 1877 SCIENTIFIC AMERICAN, INC.

Curiosities of the Railway Ticket Manufacture.

Chambers' Journal gives the following interesting account of how railway tickets are made at a celebrated factory in London, that of Waterlow & Sons:

Like many other great establishments, Messrs. Waterlows' has grown from a small affair to gigantic proportions. Beginning with law stationery, then advancing to account book manufacture, then to various kinds of commercial printing, it has gone on, step by step, until at present it gives employment to between three and four thousand persons.

One of the factories, consisting of a lofty building surrounding an open quadrangle, is devoted to ticket making and printing, chiefly railway tickets; and to the process as carried on there, we will now direct our readers' attention.

The paper for tickets is made of a slightly spongy texture, well fitted to take paste. It is known technically as middles, and is the foundation for two external surfaces of paper, white or colored as the case may be. The primitive paste-brush has long been discarded. A cleverly constructed machine pours out a stream of paste on two rollers, under or over which pass two sheets of paper, each of which becomes thoroughly pasted on one side. These are then quickly applied to the surfaces of the middle. The paste caldrons, in a compartment by themselves, have a vigorous appetite for flour, alum, and water, and pour forth volumes of steam. To show what "a bit of paste" may become when multiplied by millions, it will suffice to say that thirteen sacks of flour per week are used in this one factory! After the pasting, each sheet of cardboard, large enough for one hundred and twenty-five railway tickets, is, with others of the same kind, subjected to flat pressure, rolling pressure, and heat, until the surface papers are firmly and smoothly attached to the middle; exposure to a high temperature in heated chambers thoroughly dries them. Cutting machines sever the sheets into single tickets, the well known railway ticket size, all precisely alike in dimensions.

Next comes the printing. Messrs. Waterlow adopt four different commercial systems in the supply of these tickets. In the first system they manufacture the tickets throughout for the railway companies, who issue them ready for use to the booking clerks at the several stations. In the second, they partially print the tickets, leaving the companies to finish them according to the varying exigencies of the traffic. In the third, they sell the blank tickets, properly prepared and cut, to the companies; the printing in this case being wholly carried on by the companies. And in the fourth, they sell the machines to the companies, with a license to use them.

A pile of about five hundred blank tickets is placed in an upright tube or hopper, with just room to sink down readily. The bottom of the tube is open, allowing the lowermost blank to rest upon a flat metal plate. A slider, with a rapid reciprocating horizontal motion, strikes the lowermost blank dexterously aside to a spot where it can be printed on the back with those cautions, instructions, and references to by-laws which most companies deem proper to communicate to the public. Another sharp stroke drives the blank farther on, where the printing and numbering of the front or principal surface are effected. When the blank is printed on both surfaces, it is struck onward again, and comes underneath an exit or delivery tube, just the same height and dimensions as the hopper or feeding tube. Up this it is driven by a series of jerks, until a pile of (say) five hundred is finished. In traveling horizontally from tube to tube, and vertically up the delivery tube, each ticket acts as a kind of cardboard policeman, saying to its predecessor: "Move on, if you please." And they do move on, all undergoing some process or other at each stage of the movement. As the pile in one tube lessens, so does that in the other increase in height, like the two columns of liquid in a syphon. The whole pile can be removed from the delivery tube at once by a dexterous hand; but woe betide the luckless wight who "makes pie" (as the printers call the dropping and disordering of types in composing or distributing); for if a single ticket be disarranged, extra trouble is given in the after checking and correction.

As to the various colors displayed on railway tickets, some depend on the use of colored sheets of paper in the first instance; some on the production of stripes of color in a way bearing a resemblance to the making of colored stripes on earthenware or stoneware in the pottery districts; and some by a process more nearly resembling ordinary printing. One of the companies adopts a particular diagonal red line on all tickets, distinguishing them from other tickets which have to pass through the railway clearing house.

The automatic action of the machine or machines is very beautiful. For numbering each ticket, a peculiarly constructed wheel is used, which changes its particular digit every time a new blank is presented to it; and thus the consecutive numbers are produced on a series of tickets with unerring accuracy. A tell-tale index and a tell-tale bell, both automatically worked, give information as to the number of tickets printed, and the readiness of the machine to take in more food; but it is a matter of practical detail whether and when these tell-tales shall be deemed necessary. To give the reader an idea of how nicely this mechanism is adjusted, it refuses to work unless all the tickets are exactly of equal size, nicely squared, and in perfect order. It strikes one as being almost like a thing of life to see the machine detect a ticket from which a piece has purposely been torn off one end; its language is virtually: "Thus far shalt thou go, and no farther," for its prints as far as the defective ticket, and there stops.

As neither human fingers nor automatic machines are absolutely infallible, errors in numbering may occur in spite of all precautions. These are detected in a singular way. All the tickets in one series are made to pass through a machine with a velocity which the eye can scarcely follow. When stopped, the numbers are tested by two little index plates or wheels; if the same number is denoted on both indexes, all is well; but if any error has crept in, the index notifications differ, and afford means for determining at what part of the series the mishap has occurred.

A sheet of cardboard is certainly not a ponderous substance; but it is surprising how weighty the packages become when large quantities have to be dealt with. The tickets are tied up into small compact rows (string and tying being peculiar), and then packed into cubical masses in tin-lined boxes or cases—so firmly and closely pressed as to be as dense as a mass of wood. About fifty thousand tickets weigh one and a quarter hundredweight. The factory turns out two and a half millions of printed tickets (railway, steamboat, refreshment, etc.) per week, and ten millions of smoothly prepared but unprinted tickets; these numbers multiplied by the fifty-two weeks in a year, give a total annual production of something like six hundred and fifty millions, weighing upwards of sixteen thousand hundredweight! If these tickets be taken at two inches in length, and if they were laid flat, end to end, they would reach—— But we leave our junior readers to exercise their arithmetical skill in solving this problem: merely hinting that it would require many voyages from England to America, and back again, to cover a distance equal to the length of this cardboard ribbon. From such small beginnings do great results ensue.

The Niagara Railway Suspension Bridge.

It is said that a curious spectacle is daily presented at the Railway Suspension Bridge, near Niagara Falls, N. Y. Whenever a passenger train arrives, weighing in all, say 150 tons, the passengers are ordered out of the cars and requested to walk over the bridge, on the pretence of better safety; but at the same moment, and while the passengers are on the bridge, the heaviest freight trains and locomotives, weighing 230 tons or more, are passing over the upper floor of the same bridge, directly above the heads of the passengers.

It appears that the Great Western Railway Company is the lessee of the bridge, for which, by agreement, they pay fifty-five thousand dollars a year rental to the Bridge Company. Owing to the fall in the price of materials, the Great Western might now build a new bridge, of their own, at a cost the interest whereof would be considerably less than the present rental. But the only way to escape this rent is to break the lease: which might be done if the bridge should be decided by the referees to be unsafe, not otherwise. The Bridge Company lately caused a most careful examination of the bridge to be made by several of the ablest engineers, whose report, recently published by us, showed that the structure was in splendid condition as to strength and safety. But the Great Western Company still aim to get a decision of the referees, one of whom they have appointed, one has been selected by the Bridge Company, while the third remains to be chosen by the other two. They have not yet been able to agree upon the third referee. In the meantime, it is supposed that the object of the Great Western Company in compelling the unfortunate passengers to bundle out and walk the bridge at every trip is to create a public opinion, in advance, against the safety of the bridge, in the hope of thus influencing in their favor the decision of the third referee, whoever he may be.

Transmitting Photographs by Telegraph.

A French *savant* has proposed some method by which a photograph may be transmitted from one place to another by the agency of the telegraphic wire; but we have not yet been able to learn anything of the means proposed to be adopted for securing so desirable an end.

We are, however, says the *British Journal of Photography*, in a position to give details of a method by which a photograph may be transmitted with the "speed of thought" to any part of the world with which the sender is placed in electrical communication. But this transmission is subject to compliance with certain modifications by which the original character of the picture, as a photograph, must be slightly altered, although this alteration is not necessarily any greater than that to which it has to be subjected before it meets the eye of the public as an engraving in any of our illustrated periodicals.

Rather more than twenty years since, Mr. F. C. Bakewell, the author of a well known treatise on "Electric Science" and other philosophical works, invented what he termed "the copying telegraph." By means of this system the very handwriting of the person who wrote a message could be transmitted in *facsimile* to his correspondent, all errors in transmission being avoided owing to the fact of the message being traced by mechanical agency from the original document. To render clear our description of a method by which a photograph can be telegraphed, it is necessary that we should give a brief account of Mr. Bakewell's clever invention.

Premising that paper can be prepared with certain chemicals (such as a solution of prussiate of potash and hydrochloric acid) which are decomposed by the passage of an electric current, the decomposition resulting in a visible mark at any or every place where a sharp point in the electric circuit is allowed to touch the paper, it will be readily comprehended that to bring such a sharp point in communication with the paper so prepared is a feat that can very easily be accomplished at a point distant thousands of miles. Mr. Bakewell's invention consisted in causing the communication to be written on tinfoil with an ink which was a non-conductor of electricity. The letters thus written formed on the surface of the metal a number of non-conducting marks. If, now, this sheet of tinfoil, previously trimmed to a definite size, be wrapped round a cylinder which will just suffice to permit of its going once round: if, further, this roller, placed in the electric circuit, be made to rotate at a definite rate of rapidity, and with a spiral or progressive motion from one end to the other in relation to a fixed point: it will be obvious that if this latter point be a needle mounted with sufficient elasticity to rise and fall as it passes over the heights and hollows of the letters which rotate underneath its point (which must be blunted so as not to scratch), a current of electricity will be transmitted to a distance which will be continuous only in the ratio of the immunity enjoyed by the ground, or tinfoil, from the breakages caused by the constant interruption of the non-conducting ink with which the message is written.

The drum or cylinder containing the communication being rotated, spirally, at one end of the telegraph wire, it now remains to be shown how the message is received at the other end. A cylinder, of precisely similar dimensions to that round which the communication is to be sent, must be ready at the receiving end of the wire, and round this must be wrapped a sheet of paper prepared in the way we have indicated. It, too, like the former cylinder, must be pressed upon with a needle-point tracer, and, like the original, it must also be made to rotate at a certain velocity previously determined upon, and, finally, it, too, must be made to move slowly from end to end, so that the point shall pass over it in a continuous line or spiral. It only now remains that, all things being ready, the clockwork be started, when the former roller will rotate under a point which is transmitting electricity subject to the interruptions caused by the letters of the message. As the paper on the receiving roller is traveling both in a circular and lateral direction at the same rate, it is evident that every touch of the tracer on the original communication will be rendered visible on the blank paper at the other end of the wire, the only difference being that, whereas the original communication is dark on a white ground, the message is received in light letters on a dark ground.

To transmit a photograph in accordance with the principle here laid down, it is first of all necessary that it be converted into lines. With our present knowledge of electrical communication, we must not expect the electric current to discriminate between thick and thin non-conductors; and until this has been achieved, if it ever will be, graduated tints must remain in abeyance. To convert a photograph—a portrait, for example—into lines, a print should be made on silver paper in the usual way, and this must be traced over with black ink, using a fine pen. When the tints have in this manner been translated into lines, the photograph is immersed in a diluted solution of bichloride of mercury in hydrochloric acid, by which the photographic image will disappear, leaving the pen-and-ink drawing only visible. If from this a negative be taken and a print in carbon be made upon a sheet of tinfoil, all the electrical conditions requisite for effecting the transmission of this drawing to any distance will have been complied with. The gelatin which forms the blacks, or lines, of the carbon print is a non-conductor; the base, on tinfoil, upon which the print has been developed, or to which it is permanently attached, is a conductor, and nothing else is required in order to effect the transmission of the picture in the manner we have described.

The accuracy of any likeness thus transmitted will depend upon two things: First, the fidelity with which the artist who is employed to make the pen-and-ink tracing effects his work; and, secondly, the adoption of such means as will insure both cylinders (the transmitting and receiving cylinders) rotating with a similar degree of speed—a matter involving no difficulty whatever.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Connecticut.

FIRE ARMS PATENT.—THE UNITED STATES RIFLE AND CARTRIDGE COMPANY AND E. REMINGTON & SONS *vs.* THE WHITNEY ARMS COMPANY *et al.*

[In equity.—Before Shipman, J.]

This was a bill in equity to restrain the defendants from an alleged infringement of letters patent granted to John W. Cochran on May 7, 1872, for improvements in breech loading guns. The plaintiffs are the owners of the patent, and E. Remington & Sons, for whose benefit the suit is brought, are the exclusive licensees thereunder. The answer of the defendants denies infringement upon their part, and also denies novelty of invention upon the part of the patentee, and alleges that the application of the said Cochran for a patent was filed on May 6, 1868, and that for more than two years prior to said date the invention had been in public use and sale with the consent and allowance of said Cochran, and that prior to the said date the invention had been abandoned to the public.

Held by the Court:

The provisions of section 35 of the act of 1870, that upon the hearing of the renewed applications therein referred to, abandonment should be considered as a question of fact, does not render delay of itself conclusive evidence of abandonment, but makes the decision of such cases depend upon the peculiar circumstances as a question of fact and not of law.

The decision of the Commissioner in regard to the questions which have been committed to his exclusive jurisdiction is final—such as the sufficiency and competency of the formal acts and proofs which the statute provides shall be a prerequisite to the issuing of a patent; the existence of those facts upon which a reissue is to be granted or an extension made; and the sufficiency of the reasons for delay exceeding two years in prosecuting an application made since the act of 1870.

The granting of a patent is *prima facie* but not conclusive evidence that the right to the invention has not been surrendered to the public, and the same is true in regard to abandonment upon renewed applications which were made under the 35th section of the act of 1870.

All the defenses which the statute authorizes may be made as well in respect to patents granted upon applications renewed under the 35th section of the act of 1870, as in respect to those issued upon original applications.

Lapse of time, *per se* does not constitute abandonment.

The filing of an application is conclusive evidence that at its date the inventor did not intend to give his invention to the public, but it is not conclusive evidence that he did not subsequently do so.

Cochran's application was filed January 11, 1859, withdrawn February 20, 1860, and not renewed until after a period of eight years had elapsed. He, in the meantime, made numerous other inventions of a kindred nature, and obtained twenty-two patents thereon, constantly engaged in their development, and though poor, not thereby deterred from prosecuting his other inventions, and could have obtained a patent on this or at least kept the application alive had he so desired. Meanwhile the invention was

© 1877 SCIENTIFIC AMERICAN, INC.

patented by others, and finally introduced in 1867, a year before Cochran filed his second application. Held; that while the new petition did not of itself sever the second application from the first, his acts and conduct show that the proceeding had been abandoned, and there was no continuity in the two applications.

The case distinguished from Smith *vs.* Dental Vulcanite Company, where the first application had never been withdrawn, and the inventor was unremitting in his endeavors to obtain a patent.

Forfeiture or abandonment may be inferred from the acts of an inventor who, without substantial reason or excuse, neglects the use of his invention and sleeps upon his rights for a number of years, while others in the meantime produce the same thing and give the public the benefit thereof; and the same is true whether the device be patented or had gone into use, without a patent.

A use for the mere purpose of competitive examination, experiment, and test, is not a public use.

Bill dismissed.

[*Frederick H. Betts and George Gifford*, for plaintiffs. *Benjamin F. Thurston and John S. Beach*, for defendants.]

Inventions Patented in England by Americans.

From March 31 to April 9, 1877, inclusive.

BOOT MAKING MACHINERY.—S. Henshall, Philadelphia, Pa.
CONTROLLING CRANES, ETC.—T. A. Weston, Stamford, Conn.
EXERCISING APPARATUS.—G. W. Wood, New York city.
EXHAUST NOZZLE.—T. Shaw, Philadelphia, Pa.
FLANGE MACHINE.—C. Miller *et al.*, Pittsburgh, Pa.
LAMP GLOBE, ETC.—Meriden Glass Company, Meriden, Conn.
MOWER.—J. R. Parsons, Hoosick Falls, N. Y.
RECOVERING TIN FROM SCRAP.—N. S. Keith, Brooklyn, N. Y.
REFINING SUGAR.—F. O. Matthiessen, Irvington, N. Y.
ROVING TWISTER.—J. S. Kirks, Chester, Pa.
SCRAP BOOK, ETC.—B. J. Beck, Brooklyn, N. Y.
SHUTTLE.—D. H. Chamberlain, Boston, Mass.
STENCH TRAP.—J. H. Mackie, Oakland, Cal.
TIME GLOBE.—L. P. Jewet, Glen's Falls, N. Y.
TRIMMING BOOT HEELS.—J. H. Busell, Boston, Mass.
TRUNK, ETC.—W. S. Soule *et al.*, Mass.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED COFFEE POT.

Richard L. Nelson, Orange Court House, Va.—This invention is an improvement upon that for which letters patent have been lately granted to same party. The objects aimed at in the present improvement are to render the former "drip attachment" more compact, to lessen the number of parts composing it, to reduce the cost of the same, and to lessen the time required for making coffee.

IMPROVED SCRUBBING MACHINE.

Peter Byrne, Jr., Norwalk, Wis.—This machine consists of a wheeled frame, carrying a reciprocating scrubber and mechanism for operating it; also a water holder, which is connected with the scrubber by a flexible tube, and a mop and pan, for taking up the water that has been used in the scrubbing operation. The machine is pushed about on its wheels, so that the floor is both scrubbed and mopped as the machine advances.

IMPROVED MOSQUITO NET FRAME.

Johann F. Volle, Houston, Tex.—This invention consists mainly in vertical posts or rods, swiveled to the head of a bedstead, and having horizontal arms to which the net is attached by means of sliding rings. The invention further consists in connecting the said arms by a crossbar or rod which is adapted to slide thereon, and to which the net is likewise attached in the same manner as to the swinging arms. The invention further relates to the peculiar arrangement of cords for adjusting or operating the swiveled posts and extending or retracting the net.

IMPROVED SPRING BED BOTTOM.

William M. Edmans, Troy, N. Y.—This invention consists in wire springs, bent into forked or branched form, having their ends turned upward, to enter the lower side of the end rails of the bed bottom. The upper outer corners of the end rails are rounded off, and the springs are curved inward above them. The ends of the springs are bent upward at right angles, to enter holes in the spring slats.

IMPROVED LAMP SHADE HOLDER.

Hiram L. Ives, Troy, N. Y., assignor to himself and T. Henry Dutcher, of same place.—This is an improved illuminating shade holder for lamps, by which different sized shades may be used, and a more perfect combustion and brighter light without the use of a chimney produced. The holder is made of inverted conical shape and of transparent glass, the angle of the sides being so arranged that the rays of light are reflected from the shade at the opposite side of the holder. The upper circumference of the shade holder is provided with two flanges, of which the inner flange is supported on an inclined collar, and slightly below the level of the outer flange, so that a shade seated on the inner flange will almost touch the outer flange and form a neater finish therewith.

IMPROVED KNIFE-SCOURING PAN.

David H. Cassel and George W. Zint, Crestline, O.—This is an improved pan for the convenient scouring of knives and forks; and it consists of a sheet metal dish or pan with inclined center plane or rest piece for the knives and forks, and a front partition, providing a receptacle for the scouring powder. The scouring powder is taken up and applied directly to the knife or fork, bringing always a fresh quantity in contact with the same as the spent powder is dropped from the rest piece into the spaces at both sides of the same. The inventor claims that the scouring of knives and forks is by this pan accomplished in a neater and more convenient manner, the pan forming a clean and readily available device for that purpose.

IMPROVED BUTTER DISH.

William H. Fitch, Brooklyn, N. Y.—This butter dish or plate is stamped up of a sheet-metal blank in the customary manner. The sides of the dish are made straight with outward inclination, and connected at the corners by outwardly projecting mouldings, which are thrown beyond the outside edge of the dish by narrow tapering sections, that extend at right angles, or nearly so, from the sides. This outwardly projecting section serves not only to stiffen the sides, but mainly for the purpose of providing for the surplus stock at the corners, and avoiding the creasing or wrinkling of the sides by the too large quantity of stock at the rounded off corners. The throwing or bulging out of the corners has the additional advantage of requiring less power in stamping the dishes, so that two or more may be stamped up by the same blow, and of producing a smooth, stiff, and durable dish of uniform appearance, and without the objectionable folds or creases that are generally found in sheet-metal dishes of this kind.

IMPROVED PROVISION SAFE.

Ezra Webb, Brooklyn, N. Y., assignor to Mrs. S. E. Shutter, New York city.—This invention is intended to be placed in a window when there may be a scarcity of closet-room, to receive cooked and uncooked provisions, and to be so constructed that it may serve also as a refrigerator. A safe has wire cloth in its front and back, so that the air may pass through it freely. The top of the safe is made inclined, so that the rain may run off it freely. The front of the safe may be provided with a single door or with double doors, as may be desired. In the bottom is placed a pan in which may be placed a rack to receive ice, shelves being placed in the upper part of the said compartment. The drip water from the ice chamber may be received in a pan or other receptacle, or may be conducted away by a pipe.

IMPROVED WASHBOARD.

William Serviss, Sidney, O., assignor to W. M. Serviss & Co., of same place.—This invention consists in making a washboard entirely of metal, the object being to provide a washboard that will not warp when subjected to the action of hot water and soap, and that is light, durable, and easily repaired.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED FELLY.

William A. Wharton, Belle Centre, O., assignor to himself and H. E. Lambert, of same place.—In this invention, a section of felly, is made from malleable iron, or any other suitable metal, so as to present the same exterior form and appearance as the ordinary wooden felly; but from its peripheral or tire side it is chambered out to lighten and cheapen it. Holes are made in it to receive the spokes, and from one of its ends a dowel projects, and in the opposite end a hole is made to receive the dowel of the adjoining felly section. These holes may be provided in both ends of the felly section, and a pin or bolt used to connect the adjoining ends of the fellies, if desired. A block, having the same form as the transverse section of the felly, provided with a central opening for receiving the dowel, is placed between the ends of the felly sections when the wheel is made; and when the spokes become worn, so that when it becomes necessary to contract the rim of the wheel, one or more of the said blocks may be removed and the rim contracted, so as to force the spokes farther into the hub when the tire is shrunk on.

IMPROVED FASTENER FOR MEETING-RAILS OF SASHES.

William T. Doremus, New York city.—This is an improved window sash stop, so constructed as to operate automatically to fasten the sashes when they are closed, so that it is impossible to close the window and leave the sashes unfastened, and which may be also used to lock the sashes, so that they will not shake and rattle with the wind. The invention consists in combining with a stop pivoted to plate, and having a toe, a pivoted lock plate having upwardly projecting inclined flanges and shoulders upon its sides. The stop is so formed that, when left free, its weight will cause its lower forward corner to project, so that when the upper sash is raised into place, or the lower sash is lowered into place in closing the window, the corner of the stop will be over the top rail of the said lower sash, and the window will be securely fastened.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COIN TRAY.

Albert A. Hyde, Wichita, Kan.—This is an improved tray for the use of bankers and others using large quantities of coin, to enable them to have the coin in a convenient shape, and to facilitate the removal of the coin from the tray when desired. The sides of the tray are attached to the side edges of the bottom, the lower parts of which project below said bottom to serve as feet, and are so formed as to give the bottom a slight forward inclination, to prevent the coin from falling out at the open rear side. The interior of the tray is divided into compartments by vertical partitions, which are attached to the bottom and the front. The partitions are so arranged that the compartments may correspond in width with the diameter of the coins to be placed in them. The bottom of the tray is graduated or made of different thicknesses, so that each pile of coin, when made level with the top of the tray, may contain even dollars, and may thus prove the count or render the counting of the full piles unnecessary. A handle is formed upon or attached to the rear edge of the bottom for convenience in handling the tray. A lifter is used for removing the piles of coin from the compartments of the tray. The forward end of the lifter is concaved to rest against the side of a pile of coin, and to the lower edge of the forward end of said coin-lifter is attached a thin metal plate, to be slipped beneath a pile of coin, so that the whole pile of coin may be removed at once when desired.

IMPROVED STATION INDICATOR.

John Peter Schmitz, San Francisco, Cal.—This apparatus is simple in construction, and operated by the driver of the street car, or brakesman of the steam car, on which it is placed. It indicates the streets or stations passed on the route by the names thereof appearing through a slot in the side of the case containing the endless traveling apron on which the names are printed. The apron passes around suitable rollers.

IMPROVED WATER ELEVATOR.

Abraham Vantrump, West Elkton, O.—The buckets on an endless chain empty into a trough above the platform, with exit-spout to keep up a steady stream. By reversing the motion of the elevator, the buckets are emptied, which is of advantage in summer, as there is no water wasted, and the same is always obtained fresh and cool, while it prevents in the winter season the freezing of the contents of the buckets.

IMPROVED COTTON CHOPPER.

John P. Harrisson, Aberdeen, Miss.—This cotton chopper is so constructed as to chop the crop to a stand by being drawn across the field. The hoes may be adjusted wider apart or closer together, according to the number of stalks desired to be left.

IMPROVED LEVEL.

Thomas H. Burk, New York city—This invention admits of convenient observation from top and side during use; and it consists of a level and plumb having indicators, which are operated by a weight hung to the center shaft of the side indicators, and working at the same time a top indicator by bevel gear connection. A vertically supported shaft, that passes through the top dial, carries an index hand at the upper end, which hand is in line with the side indicators when they are in vertical position, but follows the motions of the side hands in exact manner, so as to instantly indicate whether the rule is in level or plumb position or not. The joint working of the index hands facilitates the use of the implement, as the positions of the hands may be seen at a glance from the side or top without necessitating stooping down to observe the side indicators.

IMPROVED HORSE COLLAR.

Hezekiah W. Whitney and Charles F. Whitney, Oswego, N. Y.—This horse collar is from parts of peculiar form, secured together by means of rivets and stitching, so as to form a durable and comfortable collar. The face of the pad, or part of the collar that comes into contact with the horse's breast, is cut with a convex outer edge and a curved inner edge. The ends of the face part are cut diagonally to fit the other portions of the collar to which it is attached. The threads of the stitching draw the inner and outer surfaces of the collar together, forming one crease for receiving the hames, and another for relieving the pressure on the breast of the horse and preventing galling. A flat surface is formed for relieving the horse's breast from pressure. This surface is quilted to prevent it from becoming convex.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WINDMILL.

Daniel Nysewander, Springfield, O.—This invention consists in the combination of two segmental gear wheels, two regulating vanes, and an adjustable weight with the turn-table and the main vane; in the combination of the flaring flanges with the edges of the wings of the wind wheel; in the combination of brace bars with the flanges and the wings of the wind wheel; and in the combination of upright bar, cross bar, hinge bar, and the vane. It is too elaborate an invention to be adequately described without engravings.

IMPROVED COTTON PRESS.

James Templeton, Florence, Ga.—The object of this invention is to furnish a hand power cotton press of cheap, simple, and effective construction, by which the packing and baling of cotton or other material are facilitated and accomplished with less danger from the fulcrumed lever. The invention consists of a lint box, filled from the top, and is operated by an upwardly moving follower and sliding top panel. The base frame of the cotton press is supported on cross sills, and provided with uprights that are braced in suitable manner to the base sills, and strengthened by lateral pieces, so as to form a strong and rigid support for the lint box. The lint box extends either through the floor of the building from the lint room down to the ground, or the same is provided, when the press is put up outside of the shed or building, with a platform around the lint box, at suitable height above the base frame or sill.

IMPROVED MACHINE FOR WINDING HAY INTO ROLLS FOR FUEL.

Ebenezer Harding, Delavan, Minn.—This machine winds hay or straw into rolls or twists for the purpose of using the same in a compact and convenient form for fuel; and the invention consists of a flat revolving spindle, in combination with a sliding and lever-acted pressure roller, the hay being wound upon the spindle, which is withdrawn when the roll is finished. After the hay is attached to the spindle by being wound once or twice around the same, the spindle is revolved by one hand, and the roller pressed at the same time tightly, by the lever, with the other hand, against the hay, so as to form a closely wound roll of hay or straw, of any desired size, around the spindle. When the hay has the required size, the spindle is withdrawn, by pulling the crank sidewise, and the roll removed. The next roll is then formed in the same manner, and thus any quantity of the surplus hay or straw is worked up quickly into rolls of compact shape, which may be used in convenient manner as fuel, in place of wood, and burned in any stove.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

Harrison Wagoner, Coshocton, O.—This planter is so constructed as to open a channel to receive the seed, drop the seed at uniform distances apart, cover the seed, and mark the rows, so that the planting may be done in accurate check row. By this construction the dropping slides are drawn back to drop the seed with a slow movement, and are pushed forward to again receive seed with a quick movement, so as to jar the seed and insure the filling of their dropping holes.

IMPROVED PLOW.

Robert B. Thomson, Dansville, Mich.—This plow consists of a combination of a mould-board, point, landside, forward standard, rear standard, and beam. The standards are made with bends or offsets near their upper ends, to bring the beam directly over the line of resistance. The upper end of the forward standard has a forward projection or arm formed upon it, through which passes the bolt that secures and pivots the beam to the said standard. Upon the upper end of the rear standard is formed a projection or plate, which is made in the form of a section of a circle. The forward edge of the plate is concaved, and has a flange formed upon its lower side to receive the hook of the hook bolt, which passes up through the rear end of the beam, so that by loosening the nut of the bolt the rear end of the plow beam may be moved from or toward the unplowed land, to adjust the plow to take or leave land, as may be desired. The colter is entirely independent of the beam, and may be adjusted up or down and toward or from the land, as may be desired. The handles are connected by rounds, the lower ends of which are secured to the landside and mouldboard by bolts, the upper bolts passing through slots, so that the rear ends of the handles may be raised and lowered to correspond with the height of the plowman.

IMPROVED CORN PLANTER.

Charles L. Goethals, Los Angeles, Cal.—This machine is so constructed as to open a furrow to receive the seed, drop the seed, and cover it. The new feature consists in the lever which works the dropping slide.

IMPROVED DITCHING MACHINE.

Thomas N. Turner and Santford Turner, Rushville, Ind.—The sides of the ditch are cut by colters, the lower ends of which are attached to the forward corners of the share. The cutting edge of the share is made V-shaped, and its rear part is inclined upward, so as to deposit the dirt upon the endless belt of the elevator. With this machine a slice about six inches deep may be taken from the bottom of the ditch at each passage, and by passing back and forth a sufficient number of times the ditch may be sunk to any desired depth.

IMPROVED CORN SHELLER.

Herman Neubert, Ironton, O.—The forward part of the shaft is divided into four branches, to the outer ends of which is attached a ring plate. Upon the inner edge of the ring plate are formed four knives, the edges of which are inclined, and which are bent into such a shape that their said edges may rest upon the ear diagonally. To the branches of the shaft, at a little distance from their ends, is attached a ring plate, upon the inner edge of which are formed lugs which are bent forward at right angles to extend along the ear longitudinally. A tube keeps the kernels from scattering as they are removed from the cob by the knives and lugs.

IMPROVED HAND CORN PLANTER.

William E. Seelye, Anoka, Minn.—The lower part of the front of the seed chamber is formed of a spring plate, which will spring inward to close the chamber when a plunger is raised, and is pushed outward to allow the seed to drop into the ground when the said plunger is pushed down. The plunger is attached to the lower end of a bar, that slides up and down upon the inner surface of the back of the chamber and seed box, and is connected with the lower end of a handle which slides upon the outer surface of said back by two bolts. The bolts pass through a longitudinal slot, formed in the back of the planter and through a block or blocks placed in the said slot. The block or blocks keep the bar and handle at the proper distance apart, and also prevent the side edges of the bar from wearing the sides of the chamber.

IMPROVED CORN-GUARD FOR PLOWS.

Edward B. Murphy and Charles D. Bramell, South Point, Mo.—This is an improved device for attachment to the beams of plows to prevent soil and clods from being thrown against the young plants. It is a hollow cylindrical casting, made with its outer end closed, and upon the upper and lower sides of which are formed lugs to receive bolts which pass above and below the plow beam and through the ends of a bar placed upon the other side of the said beam, so as to clamp it between the said casting and bar. A spring holds the guard plate down to the ground and, at the same time, allows it to rise to pass over an obstruction. The device may be attached to the beam of a shovel plow, a turn plow, or any other desired kind of a plow.

IMPROVED CORN PLANTER.

H. William Meyerhoff, Waverly, Iowa.—This invention relates, first, to the means for changing the angle of the tongue to the frame of the planter, for the purpose of varying the depth at which the furrow-openers deposit the seed in the ground; secondly, to the mechanism for reciprocating the seed slides, and the arrangement of a clutch for throwing the same into, and out of gear with one of the transporting wheels; and, thirdly, to making the driver's seat adjustable by a particular construction.

IMPROVED PLOW.

Daniel P. Ferguson, Jonesborough, Ga.—This invention is an improvement in the class of plows having pivoted adjustable standards, and it relates to the employment of a curved or angular notched brace for the plow standard, and a weighted key for confining the brace. The invention further relates to the provision of a slotted stay-piece for preventing the share or shovel turning on the bolt by which it is attached to the standard.

© 1877 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Wanted—The address of Manufacturers of Small Patented Articles. such as Toys, etc. S. Potts, W. S. S. "Intrepid," Navy Yard, New York.

Lithographic Stone Grinders. Simplest, cheapest, and best in use. Send for illustrations and testimonials. Frank Thomas & Co., Home St., Cincinnati, O.

Steam Yachts for sale, new, 14 feet long, 4 feet beam, ½ h. p., $250; 18 feet long, 4½ feet beam, 1 h. p., $355; 21 feet long, 5½ feet beam, 2 h. p., $425. Shipping weights 450, 800, and 1,200 lbs. Will carry comfortably 4, 8, and 12 persons. Send for particulars. S. C. Forsaith & Co., Manchester, N. H.

Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

For sale cheap—Two valuable Patents (Household Articles). Address J. A. Worley, Cleveland, O.

Parties having Room and Power, favorable located, and would like to assist in establishing a profitable Manfacturing business in the Hardware line, are requested to address for particulars, P. O. Box 451, Athol, Mass.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

For Sale—33″ Lathe, $350; 5 ft. Planer, $290; 25″ Lathe, $190; 26″ Lathe, $290; at Shearman's, 132 N. 3d St., Philadelphia, Pa.

Iron Circular Saw Tables. An incomparable tool for shop work. Prices reduced. Illustrated circulars. Paterson, N. J. W. H. Havens.

For Sale.—21 in. 10 ft. Lathe, $190; 17 in. 8 ft. do., $175; 16 in. 10 ft. Wheeler do., $225; 18 in. 5 ft. do., $95; all back geared and screw cutting. 2 No. 5 Steam Pumps, $75 each; 5 ft. Whitcomb Planer, $325. Shearman, 132 N. 3d St., Philadelphia, Pa.

New Steam Yacht for sale, 35′ x 6′ 10″; also Yacht Engines, Propellers, etc. Wm. J. Sanderson, 21 Church St., Syracuse, N. Y.

How to make Violins. Write to J. Ranger, Syracuse, N. Y.

Platform Clothes Wringer, Centennial Prize Medal Awarded for being "perfectly self-regulating, and well fitted for the purpose intended." License to manufacture granted. J. K. Dugdale, Richmond, Ind.

Glass Cylinders Tempered in Oil. T. Degnan, 129 Milk St., Boston, Mass.

Practical Plumbers wanted as Agents for Improved Hydraulic Engine (highest Centennial award) for Blowing Organs. Address H. L. Roosevelt, Church Organs, New York.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Wood Working Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 11 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsaith & Co., Machine dealers, Manchester, N. H.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Arny, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Amateur Photographic Apparatus, Chemicals, etc. Complete outfits, $5 to $25. E. Sackmann & Co., manufs., 278 Pearl street, near Fulton street, New York.

Consumption Cured.—An old physician retired from active practice, having had placed in his hands by an East Indian missionary the formula of a simple vegetable remedy for the speedy and permanent cure for Consumption, Bronchitis, Catarrh, Asthma, and all Throat and Lung affections, also a positive and radical cure for Nervous Debility and all nervous complaints, after having thoroughly tested its wonderful curative powers in thousands of cases, feels it his duty to make it known to his suffering fellows. Actuated by this motive, and a conscientious desire to relieve human suffering, he will send, free of charge to all who desire it, this recipe, with full directions for preparing and successfully using. Sent by return mail by addressing with stamp, naming this paper, Dr. J. C. Stone, 32 North Fifth Street, Philadelphia, Pa.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie. Pa.

At half price—line cold-rolled shafting; 425 feet, 2,½ to 4 inch, with hangers and taper sleeve couplings; good as new. Address Taper Sleeve Coupling & Wooden Pulley Works, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

A. B. W. should put his questions as to saw and shingle machines into comprehensible language.—T. J. P. will find directions for setting a boiler on p. 339, vol. 33.—J. G. E. and many others are informed that there is no formula for the horse power of a boiler.—E. L. N. will find directions for the decalcomanic process on p. 275, vol. 34.—O. C. S. can gild the devices on china ware. See p. 43, vol. 29.—R. T. C. does not give sufficient data as to the wire becoming brittle by exposure to the atmosphere.—T. W. will find directions for making oxygen on p. 75, vol. 32.—A. H. (of Niedergrund, Bohemia) can cut gas retort carbon with a hand saw.—L. F. C. should give his tinplate a coat of oil paint, and let it dry. He can then fasten cloth to it with waterproof glue; see p. 43, vol. 32. For a description of the compound engine, see p. 243, vol. 32.—D. McI. will find on p. 218, vol. 34, directions for making the so-called eggs of Pharaoh's serpents. Asbestos is regularly advertised in our columns.—W. G. W. will find directions for nickel plating on p. 235, vol. 33.—J. O. F. will find instructions for making friction matches on p. 75, vol. 29.—C. W. will find a recipe for a cement for mending crockery and glass on p. 379, vol. 32. For mending leather shoes, see p. 119, vol. 28; for mending rubber boots, see p. 203, vol. 30.—H. C. B. is informed that tattooed marks on the arms are done with gunpowder or Indian ink. For removing the marks, follow the directions on p. 331, vol. 30.—S. H. will probably find that any good cheese, that is soft, will do to make cement.—S. will find that the cement described on p. 80, vol. 31, does not dissolve in water and does not become brittle with age.—J. M. McG., Jr., should read Paddlefast's articles on boat building in the SCIENTIFIC AMERICAN SUPPLEMENT.—H. & R. can dissolve rubber by the process described on p. 119, vol. 28.—J. W. S. can sensitize a piece of paper or metal by the process described on p. 132, vol. 35. As to changes of color by heat, see p. 201, vol. 36. As to a weather glass, see pp. 35, 67, vol. 36.—P. does not give sufficient data as to the hammering in his boiler.—W. C. P. is informed that the preparation is to be taken internally. The human hair is referred to in the question.—T. S. will find directions for fastening rubber to iron on p. 409, vol. 33.—S. R. C. will find a description of a gyroscope on p. 91, vol. 31.—T. K. & B. should know better than to believe in the possibility of an instrument indicating where gold lies buried in the earth.—C. W. K. is mistaken as to the horse power of the engine. See p. 33, vol. 33.—W. T. K. can bleach ivory by the process described on p. 10, vol. 32.—W. S. will find answers to all his queries as to lightning rods on p. 277, vol. 35.—H. R. will find directions for silver-plating without a battery on p. 299, vol. 31.—R. M. will find a formula for the power of an engine on p. 33, vol. 33.—A. I. will find on p. 123, vol. 31, directions for bluing gun barrels.—W. A. W. will find something on the expansion of mercury by heat on p. 354, vol. 26.—O. B., A. G., A. J. B., J. C., R. D. E., F. J. W., N. B., A. P. Q., F. J. N., R. B., C. W., F. C., W. L. McL., A., C. A. R., D. H., H. L., and many others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. W. H. asks: Please tell me the ultimate weight that the two following girders will bear? One is a cast iron girder, nearly of the Hodgkinson proportions, 7 inches wide at base and 8¼ inches high; and the other is a wrought iron girder or flat bar size, 5 inches x ¾ inch. Both girders being fixed and anchored in strong walls, and the span 20 feet. Please give an arithmetical and not an algebraic calculation. A. Calculated by the usual formulas, the center breaking loads would be: Cast iron beam, about 3,000 lbs., wrought iron beam, about 2,300 lbs.

(2) F. A. B. asks: What is the weight of a missile, and the greatest distance that the bolt could be thrown by the large Krupp gun, that was on exhibition at the Centennial? A. Weight of ball, 1,200 lbs. Probable range, between 4 and 5 miles.

(3) F. B. asks: 1. As a boy swings a bucket of water over his head and it does not fall out, how fast would a 10 foot flywheel with globular cavities on inside rim facing center of wheel have to turn to hold balls of any substance dropped or placed in them? Would there be a different effect if the balls were composed of different materials, as wood, stone, or iron? A. About 25 revolutions a minute, whatever the material. 2. On the principle of a top, a heavy wheel can be turned readily after starting. What difference will it make if, instead of a wheel, it should be as a large governor with heavy balls on arms 8 or 10 feet long, and how much more power would have to be expended to raise those balls on a spiral incline to near the level of their attachments? A. The height of the balls varies as the square of the revolutions. 3. Suppose a perpendicular shaft, moved by cog or belt gearings, had four or more balls suspended by chains instead of stiff arms, would they not assume a similar position? A. Yes, other things being the same. 4. Suppose a tube arranged to turn and describe a circle, with outer end closed, but with an opening below, no wider than the cross section of tube, but giving perpendicular surface enough for a ball to rest against, if the ball could be held there by springs or otherwise until great velocity was acquired and then released, would it not remain there? A. Yes, as we understand your meaning. 5. I have seen a performer manipulating a top which at one time appeared to turn when standing out at right angles from the perpendicular stick that supported it. What held it up? A. Centrifugal force, which was enough to overcome the attraction of gravitation. 6. Does such a top weigh any less acting in that position than when at rest? A. No; it weighs just as much when revolving as when not.

(4) H. T. P. asks: Which has the most steam-generating capacity, and which is capable of the greatest resistance, a single boiler 60 inches in diameter and 18 feet long, or two boilers each 36 inches in diameter and 18 feet long? A. Generally, the two smaller boilers would make the most steam and sustain the greatest pressure.

(5) A. S. D. says: I have a canal about two miles long, which I use as a head race for water power. It runs along the foot of a hill and heavy rains wash dirt into it. How can I clean it out without drawing off the water? A. It would probably be necessary to use a dredging machine.

(6) W. O. R. asks: What is meant by the pitch of a steamer's propeller being 3 feet? A. It means that, if the propeller were working without slip, like a screw in a nut, the vessel would advance 3 feet at each revolution.

(7) J. A. O. Q. asks: Does not the Great Eastern consist of three complete ships? A. No; but the vessel is built with a double hull, and is divided by bulkheads into several compartments.

(8) W. D. S. says: Three men want to carry a bar of iron 9 feet long, weighing 300 lbs. One man carries an end. At what distance must the other two place a bar so that an equal weight (or 100 lbs.) will fall on each man? A. Three feet from the other end of the bar, if it is uniform in section.

(9) J. T. H. asks: Is tallow a good lubricant for cranks making 200 revolutions? Would oil be better? A. Oil is generally better than tallow for crank pins, and there are some special forms of lubricants that answer very well for crank pins and journals moving at a high velocity.

In an engine (double and vertical) 9 x 12 inches, making 200 revolutions, with a band wheel 4 feet in diameter by 14 inches face and 3 inches thick, would there be any danger of breaking the wheel by placing a weight sufficient to balance weight of pistons? A. We think there will be no danger in attaching the counterbalance.

(10) W. M. K. says: What is the rate of increase of friction in proportion to speed of a thin smooth body (such as a propeller blade) in passing through water? What proportionate amount of power would be required to double any given number of revolutions of a fixed submerged screw propeller? A. Within moderate limits, the power is supposed to vary approximately as the cube of the number of revolutions, but the exact law of the variation is not definitely settled; and when the speed becomes very great, the power is supposed to increase in a higher ratio than the cube, but experiments have not been sufficiently extended to establish a general law.

(11) G. B. says: Two bodies of metal of equal weight are to slide over a planed surface. One of these bodies has a bearing surface (supposed to be a perfect friction contact), upon the table it slides on, of 6 square feet; the other body has a bearing surface of only 6 square inches. Will it require more power to slide the body having 6 square feet bearing than it will to slide the one having only 6 inches, or will the required moving power be equal? A. According to the commonly accepted law, the friction depends upon the weight and not upon the area of contact. This rule, however, has some limitations, especially when the area of contact is so small that the pressure per square inch is sufficient to produce abrasion.

(12) H. D. M. asks: Is the phosphorus lamp described on p. 266, vol. 31, of any use? A. The phosphorus lamp may be made and used as directed in the answer, but the light which it emits is extremely weak—a mere phosphorescent glow. It is sufficient, however, in a damp atmosphere, to illuminate the dial of a watch, held close to it, so that with ordinary eyesight the time may be noted in the absence of other luminants without much difficulty.

(13) S. asks: Is there anything that will erase India ink lines from drawing paper? A. Nothing that we know of, except a good steel eraser or sanded rubber.

(14) R. H. & Co. say: 1. In our business we use brads with malleable cast iron heads, for the support of lightning rods, and we galvanize them to prevent rusting. When we use them, we find the cast iron so brittle that a great many of them break. We can come to no other conclusion than that the galvanizing makes them brittle. Are we right? A. Galvanizing iron does not make it brittle. 2. Is it necessary to throw articles that are galvanized into cold water immediately after taking out of the vat? A. No. They should not be thrown into cold water.

(15) B. F. A. asks: How can I stain wood blue, the shade of the field in the American flag? A. Brush it over with a strong, hot solution of nitrate of copper in water, and then go over the work with a hot solution of carbonate of soda (2 ozs. to 1 pint water). 2. Boil 1 lb. indigo, 2 lbs. woad, and 3 ozs. alum in 1 gallon water, and apply with a brush.

(16) C. M. T. asks: What will make photograph paper so transparent that it can be painted in oil colors on the back of a picture, so as to give a life-like color to the picture, or what preparation will make the paper perfectly transparent? A. Try Canada balsam. Paper cannot be made perfectly transparent—only translucent.

(17) C. D. H. says: Our water supply is from springs, and is soft. About two years ago, plain iron pipes were laid; and the 1 inch pipes have become so filled with a very hard rust or scale as to nearly cut off the supply. It forms in irregular masses, and adheres very firmly to the pipe. Is there any known method of preventing or removing the same without taking up the pipe? A. We do not know of any practical method for accomplishing this.

(18) C. K. asks: Can a good polish be put on copper by the recipe given on p. 326, vol. 32, and will it last a reasonable time? A. The recipe has been well recommended. It is better to use a larger proportion of alcohol than is there indicated. See also p. 242, vol. 34.

(19) B. C. M. asks: How is pyroligneous acid (wood vinegar) made? A. It is obtained by distilling wood in iron retorts, resembling those used for making illuminating gas. The condensed products of the distillation contain, with tar and numerous other bodies, crude pyroligneous acid or wood vinegar, amounting in a well conducted distillation to about 7 or 8 per cent of the wood employed. The gas that accompanies the liquifiable distillates is conducted to the furnace under the retort, and serves to continue the distillation without other fuel. In purifying the acid, it is first saturated with lime, evaporated to dryness, roasted at a moderate temperature so as to free it from volatile matters, and decomposed in a retort, having a helm of copper and a condenser of tin or silver, with hydrochloric acid (90 parts acid to 100 acetate of lime), and the acetic acid distilled.

(20) G. B. L. says: I built an oil house last fall, and lined it inside with inch boards, packing space between inside and outside boarding with pine sawdust. The oils on hand are coal oil, linseed, fish, elephant, seal, etc., also turpentine and benzine. The leakage from barrels seems to have thoroughly saturated the floor, and most likely the sawdust has absorbed whatever came in contact with it. Is there any danger of spontaneous combustion during the heat of summer? A. Yes, it is dangerous.

(21) A. H. says: Your correspondent, P., p. 212, vol. 36, seems to overlook the fact that a lightning rod having the deep earth terminal generally recommended by scientific authority, and which he does not favor, would, at the same time, have all the advantages(?) of a rod terminating "at or just beneath" the surface, such as I understand him to recommend. For, before reaching the deep terminal, the rod would come in contact with the surface of the earth; and if the electricity find there or elsewhere a better conductor, the greater portion of it would leave the rod for that conductor, instead of following the rod to the end. With a properly constructed rod, terminating with an extensive metal surface, buried in contact with such worthless scraps of metal as the clippings from tinshops, old tinware, etc., or fine charcoal, or both, in constantly (not "almost always, during a thunderstorm") moist earth, which in many instances would be most easily found in the cellar bottom: there is little probability that the electricity will leave the rod to "pass off on the wet surface" or do damage.

(22) J. P. says, in reply to D. W.'s query as to the sudden welding of a millstone spindle to its step: In the New York *Journal of Commerce*, in the first year or two of its publication, may be found an account of a similar occurrence. A spindle (I think it was of a millstone) was suddenly welded to the support upon which it was running, in the very same manner, as in the case mentioned in your paper. I believe it occurred in the year 1827, or the first half of 1828.

(23) W. D. says, in reply to D. W.'s query as to the welding of a millstone spindle to its step: I have seen this done a good many times. To prevent it, plane a groove in the step ⅛ inch wide and ¼ inch deep; harden the foot of the spindle and step as hard as possible, polish both after hardening, and you will have no trouble about welding together. The oil running through the groove prevents its welding. Use the best of sperm oil, and keep the step level.

(24) W. W. T. says, in reply to the query about the welding of mill points to their steps: I have had several such jobs to repair. The weld is perfect, and has always broken when struck in a different place from the point of union. I have to anneal the step and turn off the part of point left; and I find no check or line marring the place of contact.

(25) B. A. J. says, as to the sudden welding of a mill spindle to its step: I once had a spindle act in the same way while running in a cup of oil.

(26) W. C. says: Please give me a recipe for making powder for mining coal? A. Coarse-grained gunpowder is usually employed. The materials are first perfectly dried and separately reduced to impalpable powders. These are then sifted together, moistened with water, and ground for some time between large millstones kept constantly moist with water. The wet powder is then collected into large lumps and carefully dried. These lumps are grained by bringing them in contact with sharp teeth fixed upon the periphery of a revolving wheel, and agitating in suitable sieves to separate from the finer powder. The powder consists of 76 parts of niter, 13 parts of charcoal (often mixed with a little wood pulp or sawdust), and 11 parts of sulphur.

© 1877 SCIENTIFIC AMERICAN, INC.

(27) J. R. Y., Jr., asks: Please give me a recipe for a wash that will remove or hide marks and stains on hard finished house walls. A. We do not know of anything better than clean water to wash them. Sometimes it is necessary to cover them with kalsomine. With bad stains over a large surface, it is best to take off the hard finish and renew it carefully in those places.

(28) C. D. R. asks: Please give me recipes for making turpentine japan or paint dryer, benzine japan or paint dryer, and rubbing varnish for cabinet makers' use? A. For turpentine dryer, take linseed oil 1 gallon, put into it gum shellac ¾ lb., litharge and burnt Turkey umber each ½ lb., red lead ½ lb., sugar of lead 6 ozs. Boil in the oil until all are dissolved, which will require about 4 hours; remove from the fire and stir in 1 gallon spirits of turpentine. For benzine dryer, take linseed oil 5 gallons, add red lead and litharge each 3½ lbs., raw umber 1¼ lbs., sugar of lead and sulphate of zinc, each ½ lb. Pulverize, and boil in the oil as before. When a little cooled, thin with benzine, 5 gallons. For rubbing varnish, use a solution of pure, bleached shellac in alcohol, and apply with a smooth wad of cotton cloth, and a drop or two of oil.

(29) J. H. R. asks: What is the advantage of placing the high pressure cylinder of a marine compound engine directly above the low pressure cylinder? A. All builders do not adopt this plan. Without being able to speak officially for those who do, we imagine that they consider the principal advantages to consist in economy of space and weight.

(30) W. K. D. says: I have an acquaintance who has an open fireplace in his office, and claims that during the forenoon the sun comes into the room and deadens the fire. Is this true, and what is the cause? A. We do not believe it is true, but probably the effect of deadening is produced to the eye by the sun outshining the fire.

(31) J. A. C. says: I have a boiler made of first class iron, which commenced leaking in one of the joints. This continued until every joint was leaking. We then patched the seams, but in a short time the leaking commenced again. The water for our boilers was pumped from a well into a tank, and was then warmed by having the exhaust pipe extend into it. Our boiler maker says that the leaking was caused by the oil which was carried from the cylinder by the exhaust pipe into the water in the tank and thence into the boilers. If this is not so, please give me the correct reason? A. You do not send sufficient particulars to enable us to form a decided opinion. The boiler maker's explanation points to a possible cause, while it is more likely that the trouble is due to faulty construction, careless management, or to the use of bad water.

(32) W. E. W. asks: 1. How can I tell the weight of a flywheel where I know the diameter, width of face, and thickness of same? A. Multiply the number of cubic inches in the wheel by 0·2604, to get the approximate weight in lbs. 2. Is there a rule by which the weight of a wheel is regulated for any given horse power? A. No general rule for the size of flywheel will answer under all circumstances. We could not treat the matter satisfactorily in these columns. You will find a good discussion in Rankine's "Machinery and Millwork."

(33) J. E. C. says: I see it stated in an article on machine belts, in the SCIENCE RECORD for 1876, p. 331, that a belt wrapped one quarter round a pulley has only one fourth the power of what it would have if wrapped one half round. As an illustration of the above is given a man with a rope taking turns round a post, and states what a great power is gained according to the number of turns the rope is taken around the post. I have also known of pulleys being increased in diameter, so as to make the belt stick better and thereby have a greater power. But according to one of the laws of friction increase of surface does not produce increase of friction. How do you account for the power gained in the above cases? A. This is not contrary to the laws of friction in relation to bodies that are flexible. In these cases, it is shown that the friction depends on the angle of contact. You will find the matter discussed in treatises on applied mechanics.

(34) M. A. W. asks: 1. Will a steam boiler 4 feet long by 24 inches diameter, with a firebox 40 inches high, 16 inches wide, and 20 inches long, with 36 one inch flues, be large enough to run an engine with a cylinder, 3 x 6 inches, with 80 lbs. boiler pressure at 200 revolutions per minute? A. We think the boiler will answer. 2. Am I correct in estimating said engine at 2 horse power? A. Actual power will not exceed 1 horse. 3. Would the above engine run a traction engine with the driving wheels 5 feet in diameter, with gear wheels of 4 revolutions of the driver to one of the driven? What speed could I obtain on moderately good roads? A. With good machinery you might obtain a speed of 3 or 4 miles an hour. Your idea as to reversing an engine contained no novel features.

(35) C. A. C. asks: 1. How can I varnish a colored mechanical drawing, so that the paper and drawing will not be marred by the operation? A. You must use varnish specially prepared for the purpose, which you can probably obtain from some one who mounts show cards. 2. What must be the circumferential velocity of an iron disk (not serrated) to sever a bar of cold iron? A. Between 1 and 2 miles a minute.

(36) L. M. C. says: I am nineteen years of age, and my ambition is to learn to be a competent practical locomotive engineer. What course would you advise me to pursue in order to obtain that end? A. You should try and get employment as a fireman on a locomotive.

1. Will high pressure steam produce a higher note on a steam whistle than low pressure steam on the same whistle? A. Generally, yes. 2. Will compressed air produce the same note on a steam whistle as steam does, the pressure being alike in both cases? A. The sound is often clearer when air is used. 3. What is the best way to stop foaming in a steam boiler? A. It is often due to the construction of the boiler, or the arrangement of the steam pipe. Sometimes it is caused by dirty water or too strong a fire. The causes will doubtless suggest the remedies.

(37) J. O. says, in reply to D. W.'s query as to the sudden welding of a mill spindle and its step piece: I have had a similar experience in the uniting of hardened steel under excessive friction, due to the absence of lubricant. The foot of a steel pointed shaft, running at 180 revolutions a minute in a steel step and transmitting some 25 or 30 horse power, brought a water wheel to a sudden stop. The uniting was preceded by a pricking noise, similar to that made by an electric engine. Upon removing the shaft, a ridge of steel taken from the step was found on the foot of the shaft; and no cold chisel or file would make a mark on, and it could only be removed by a grindstone. Hardly any heat was to be felt. I believe the parts welded by wearing of parts to perfect surfaces, and then excessive friction completed the job.

(38) J. H. P. says, as to the welding of the spindle to the step plate: I think that the end of the spindle had worn a little hollow in the step plate, having the same curvature with itself. The pressure of the end of the spindle upon the bed plate had forced out the air and oil, and the two had come into actual contact, particle with particle, and were, hence, one piece.

(39) F. D. H. says: The statement of D. W. as to the welding of a mill spindle point to its step can be verified by three precisely similar cases, which have been brought to us for repairs. He is undoubtedly in error in regard to the point being well oiled. If that were the case, it would indeed be a remarkable occurrence; but when running dry, such things occasionally happen. In every instance that has come under our notice the weld was a perfect one, and defied all efforts to separate the pieces.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. A. S.—It is iron pyrites or sulphide of iron. See p. 7, vol. 36.—W. R. S.—A quantitative analysis of fire clay, etc., would cost about $15. About 2 lbs. of the material will be required. Send by express.—B. F. T.—It is indurated clay, containing markasite. See p. 7, vol. 35. It is of little value.—H. A. W.—Quantitative analyses cost from $10 to $30 each.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Valuation of Sugar. By S. W.
On the Involute of the Circle. By L. D'A.
On a Tidal Motor. By A. S.
On City Travel. By T. B. McC.
On American Progress. By ——.
On Fire Escapes. By G. L. B.

Also inquiries and answers from the following:

F. B. M.—G. S. B.—P. P. P.—L. S. B.—A. K. B.—C. P. R.—J. B. O.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes dynamometers? Where can silkworms' eggs be obtained? Who makes brewers' machinery? Who sells tobacco-flavoring composition? Who sells coffee-roasting machinery?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 3, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Agitating and mixing, G. L. Witsil..... 189,293
Agricultural boiler, McAfee & True..... 189,051
Air guns, dart for, Spring & Robinson..... 189,070
Animal poke, R. E. Atteberry..... 189,169
Animal poke, B. D. Watson..... 189,158
Arm rest, P. R Wagor..... 189,157
Ax helve shield, J. M. Larsh..... 189,109
Bag holder, J. Eberhard..... 189,202
Bail eye former, H. S. Reynolds..... 189,264
Bale tie, R. C. Pope..... 189,258
Bales, tightening bands on, M. Quinn..... 189,138
Barrels, trussing, P. Beamer..... 189,176
Baths, hot air and other, T. Keech..... 189,231
Bed bottom, spring, T. R. Jones..... 189,104
Bee hive, H. Wheaton..... 189,291
Beer kegs with soda, supplying, J. J. Schillinger.. 189,269
Belts on pulleys, throwing, R. Reinhard..... 189,263
Binder, temporary, G. W. Emerson..... 189,203
Bird cage, A. E. Mook..... 189,251
Blind slat worker, E. C. Whipple..... 189,292
Bobbin, J. Mawson..... 189,243
Boiler bottom, C. R. Everson..... 187,205
Boiler furnace front, G. L. Allen..... 189,077
Bolt heading machine, A. F. Jackson..... 189,226
Boot heel stiffener, Moore & Rogers..... 189,126
Boot heel stiffener, N. J. Simonds..... 189,066
Boot stiffeners, making, N. J. Simonds..... 189,067
Boot shank support, G. W. Wells..... 189,161
Boots and shoes, lacing, N. Evans..... 189,027
Breech-loading firearm, I. M. Earle..... 189,026
Brick machine, C. Schlickeysen..... 189,270
Bridge, Avery & Bartholomew..... 189,170
Bridge pier, Avery & Bartholomew..... 189,171
Bridge pier, E. E. Colby..... 189,020
Bridle, G. M. Strong..... 189,283
Broom machine, C. E. Lipe..... 189,240
Buckle, F. W. Schafer..... 189,268
Burial case, E. Mets..... 189,247
Burial casket, A. Fischer..... 189,208
Butter cutter, Dugan & Moncrief..... 189,025
Butter dish, W. H. Fitch..... 189,092
Butter for packing, W. B. Bemis..... 189,078
Butter pail, J. Gilberds..... 189,212
Button fastening, S. A. Hazelton..... 189,035
Cam motion, Houghtaling & Siviter..... 189,223
Cane and umbrella, M. M. Copp..... 189,084
Car axle lubricator, W. Palmer..... 189,133
Car coupling, J. Hayden..... 189,034
Car coupling, M. L. Mathias..... 189,050
Car heater, G. W. Disman..... 189,086
Car pusher, H. La Tourette..... 189,113
Car starter, W. Jasper..... 189,227
Card board, ornamental, Adams & Bett..... 189,076
Carriage, portable engine, C. M. Miller..... 189,248
Carriage seat lock, Hayward & Hays..... 189,215
Cartridge, A. B. Smith..... 189,069
Cartridge shells, varnishing, Pratt & Reynolds..... 189,057
Cast iron into steel, converting, C. W. Siemens... 189,273
Casting metals, C. & B. H. Dusenbury..... 189,090
Centrifugal dryer, etc., J. Buchanan, Jr..... 189,185
Chair and work table, G. L. Rich..... 189,141
Cigar wrapper, W. Broseker..... 189,182
Clevis, Coonley & Buckius..... 189,021
Clock lockwork, J. W. Williams (r)..... 7,594
Clothes drier, J. Kahn..... 189,229
Clutching device, H. Fuchs..... 189,210
Cocks and faucets, closing, Towle & Plass..... 189,153
Coffee mill, protector, etc., W. A. King..... 189,046
Coffee pot, R. L. Nelson..... 189,253
Coffee roaster, N. Metz..... 189,124
Coin detecter, counterfeit, J. A. Thompson..... 189,284
Coin tray, A. A. Hyde..... 189,101
Collar, standing, J. K. P. Pine..... 189,134
Cooling liquids, A. D. Puffer..... 189,137
Cork, or bung for cans, etc., T. Tully..... 189,073
Corn ball presser, C. E. Vankeuren..... 189,074
Corn drill, D. Kerschner..... 189,044
Corn planter, D. C. Bacon..... 189,173
Corn planter, H. Wagoner..... 189,156
Corn planter, hand, W. E. Seelye..... 189,142
Corn sheller, H. Neubert..... 189,130
Cotton press, C. J. Beasley..... 189,177
Cotton press, G. C. McKee..... 189,121
Cotton press, J. Templeton..... 189,148
Cotton seed planter, R. Ball..... 189,174
Crucibles, making plumbago, W. Smith (r)..... 7,593
Culinary vessel, H. C. Milligan..... 189,250
Cultivator, fallow, J. Richardson..... 189,266
Dental plugger, K. L. Mills..... 189,249
Die for sucker rod joints, G. Douglass..... 189,200
Door handle and catch, W. C. Folant..... 189,028
Dynamo-electric machine, D. F. J. Lontin..... 189,116
Eave trough fastener, A. J. Gilbert..... 189,094
Egg carrier, W. J. H. Kappe..... 189,230
Electro-magnetic regulator, R. A. Hayes..... 189,098
Engine, high and low pressure, T. L. Jones (r)..... 7,585
Envelope, R. C. Carter..... 189,189
Eyeglass, I. H. Johannes..... 189,103
Feathering paddle wheel, H. Williams..... 188,164
Feed water heater, B. Eynon..... 189,206
Felly, W. A. Wharton..... 189,162
Fence post, J. R. Peffley..... 189,256
Fence post tip, D. C. Morris..... 189,252
Fence wire barbed, O. O. Kittleson..... 189,047
Fence wire, barbed, J. McNeill..... 189,122
Flat iron heater, S. B. Dinsmore..... 189,198
Flux, composition, C. F. Secor..... 189,271
Friction clutch, M. Rumely..... 189,062
Furnace grate, B. Hershey..... 189,218
Furnaces, supplying air to, W. Halsted..... 189,097
Gas making, illuminating, J. Absterdam..... 189,166
Gas, making illuminating, J. Rigby (r)..... 7,590
Gas retorts, raking, T. F. Rowland (r)..... 7,592
Gas retorts, charging, T. F. Rowland (r)..... 7,591
Gear wheels, making, J. Comly (r)..... 7,584
Gimlets and twist drills, J. C. Richardson..... 189,265
Ginger snaps, making, Bell & Hills..... 189,178
Glass pipe coupling, H. P. Humphrey..... 180,041
Glass shades, etc., making, J. Bourne..... 189,180
Governor, J. W. Collet..... 189,193
Governor, stop motion, L. Skinner..... 189,063
Grain binder, Hodges & Blim..... 189,221
Grain binder, C. B. Withington..... 189,164
Grain elevator, floating, C. W. Mills (r)..... 7,588
Grain separator, N. Kibler..... 189,045
Grain separator, E. F. Osborne..... 185,255
Grate bar, E. Stroh..... 189,281
Grinding machine, G. A. Knowlton..... 189,235
Hammers, die for, Kip & Rieckel..... 189,232
Harrow, E. T. Bousfield..... 189,181
Harvester, O. N. Skaaraas..... 189,143
Harvester reel, E. L. Phipps..... 189,257
Hay elevator, J. & P. Lux..... 189,241
Hay elevator and conveyer, J. R. Moran..... 189,053
Hay for fuel, winding, E. Harding..... 189,097
Hinge for boxes, etc., A. F. Gerald..... 189,211
Hoe, O. H. Hicks..... 189,220
Hoisting machine, D. H. Merritt..... 189,123
Horse blanket, J. C. Ayres..... 189,172
Horse collar, H. W. & C. F. Whitney..... 189,163
Horse hay fork, P. Grant..... 189,095
Horseshoe, C. W. Atkinson..... 189,011
Horseshoe nail plates, beveling, J. M. Laughlin.. 189,111
Horseshoe nails making, J. M. Laughlin...189,108, 189,112
Horseshoe nails, making, G. L. Hall..... 189,031
Hose bridge, J. Taylor..... 189,072
Hose coupling, A. E. Rich..... 189,059
Hydrocarbon furnace, B. Hershey..... 189,217
Ice tool, J. Crawford..... 189,196
Injector, J. Proeger..... 189,259
Inkstands, filling and emptying, I. M. Fisher..... 189,209
Insulated wire, H. Redding..... 189,262
Ironing table, G. W. Hook..... 189,222
Ironing table, T. Libby..... 189,239
Knife scourer, P. Hanersperger..... 189,214
Knife scouring pan, Cassel & Zint..... 189,081
Knob latch, W. A. Barlow..... 189,013
Knobs, to shanks, attaching, W. A. Barlow..... 189,012
Knobs to spindles, attaching, W. D. May..... 189,244
Labeling machine, Knoch & Salomon..... 189,234
Lamp, W. A. Butler..... 189,186
Lamp, S. S. Newton..... 189,131
Lamp bracket, Sherwin & Hoople..... 189,064
Lamps, center, Sherwin & Hoople..... 189,063, 189,065
Lamp for hydrocarbon oils, etc., D. McCarty..... 189,246
Lamp, night, H. W. Huntington..... 189,100
Lamp or chandelier, oil, J. F. Lauth..... 189,110
Lamp screen holder, J. E. Hubbell..... 189,224
Lamp shade holder, H. L. Ives..... 189,102
Lard cooler, W. P. Harvey..... 189,082
Last, C. E. Cree..... 189,085
Lathe chuck, F. Armstrong..... 189,168
Lead furnace bottom, T. Bisch..... 189,016
Leather goods, stamping, L. H. Urner..... 189,155
Level, T. H. Burk..... 189,079
Lightning rod, L. D. Vermilya..... 189,286
Lock for sliding doors, W. C. Rogers..... 189,061
Lock, master key, F. C. Yanda..... 189,294
Locking latch, H. A. Chase..... 189,191
Meat tenderer, V. Lapham..... 189,237
Millstones, etc., balancing, C. E. Benade..... 189,014
Moulding machine, J. B. McCune..... 189,245
Mosquito net frame, J. F. Volle..... 189,287
Nail plate feeder, W. Koplin..... 189,236
Nut lock, T. Vernon..... 189,075
Oil stone holder, G. W. Dudley..... 189,089
Packing, piston, W. Rankin..... 189,140
Paint composition, S. B. Fisher..... 189,091
Paper bag machine, C. A. Nixon..... 189,056
Paper barrel machine, F. N. Davis..... 189,024
Paper boxes, L. P. Heath..... 189,036, 189,037, 189,038
Paper perforating, R. T. Smith..... 189,144
Parlor skate, H. L. True..... 189,285
Pencil sharpener, Roache & Redding..... 187,060
Pianoforte action, upright, F. Frickinger..... 189,029
Pictures, etc., preserving, L. T. Luther..... 189,117
Pile driver, steam, T. T. Loomis (r)..... 7,586
Pitman rod, B. E. Carpenter..... 189,187
Plaiting machine, T. Hagerty..... 189,030
Plow, J. Preston..... 189,136
Plow, R. B. Thomson..... 189,151
Plow, clearing attachment, J. F. Dock..... 189,087
Plow mould boards, C. Blair..... 189,179
Plows, corn guard for, Murphy & Bramell..... 189,128
Plowshares, making, C. H. Thompson..... 189,150
Portraits, incasing pocket, J. R. Applegate..... 189,167
Press metal drawing, O. Smith..... 189,277
Projectile, D. Kennedy..... 189,043
Railway switch, S. H. Finch..... 189,207
Railways, clamp for rope, W. Eppelsheimer..... 189,204
Register and punch, N. A. Ransom..... 189,261
Rein holder, Hall & Richardson..... 189,213
Rod coupling, W. C. McClintock..... 189,120
Rolling blanks for rod joints, G. Douglass..... 189,201
Rolling rings, and cylinders, R. A. Carter..... 189,188
Rope clamp, Caler & Powell..... 189,019
Rope clamp, H. T. Smith..... 189,274
Rope making machine, L. E. Higby..... 189,099
Rowlock, T. S. Popplewell..... 189,135
Safe, provision, E. Webb..... 189,159
Sash balance, Kolb & Osberghaus..... 189,107
Sash fastener, W. T. Doremus..... 189,088
Sash fastener, H. Jones..... 189,106
Sash fastener, W. E. Sparks..... 189,145
Sash holder, R. Holcroft..... 189,040
Sawtooth, insertible, T. S. Disston..... 189,199
School desk, Cogger & June..... 189,192
Scythe snath fastening, M. Smith..... 189,275
Sewing machine motor, Artley, Berg, & Dieterlea 189,010
Sewing machines, button holes, E. Moreau..... 189,254
Shaft coupling, G. A. Chapman..... 189,190
Sheet metal elbow, N. I. Rothan..... 189,267
Shingle, metal, Locher & Knispel..... 189,115
Sickle grinder, H. S. Stevens..... 189,279
Silk, etc., dressing, C. Corron..... 189,195
Skirt, J. Mark..... 189,119
Skirt supporter, W. W. Towson..... 189,154
Slate, F. W. Mallett..... 189,118
Slate washer, R. De Haven..... 189,033
Smoking pipe, B. A. Jonasson..... 189,105
Snap hook, Nash & Kempshall..... 189,129
Soap composition, Baxter & Horrocks..... 189,175
Spark arrester, E. M. Johnson..... 189,228
Stamp, perforating, G. F. Almy..... 189,009
Station indicator, J. H. Herzog..... 189,039
Steam and air brake, Taylor & McCamish..... 189,147
Steam boiler, drop tube, C. K. Heath..... 189,216
Steam boilers, fire box, B. Hershey..... 189,219
Steam engine governor, S. A. West..... 189,289
Steam radiator, G. W. Blake..... 189,017, 189,018
Stop cock locking case, H. C. Meyer & Co. (r)..... 7,587
Stove, looking, E. P. Morong..... 189,127
Stove, heating, E. Stewart..... 189,280
Stove oil, H. P. Malone..... 189,048
Stovepipe wall thimble, C. Streit..... 189,071
Sugar boiling pan, etc., W. Clough..... 189,082
Table leaf support, W. F. Daly..... 189,197
Telegraph, dial, R. J. Sheehy..... 189,272
Telegraph multiple, G. Smith..... 189,276
Telegraphy, automatic, J. W. Brown..... 189,184
Thill coupling, T. J. Hubbell..... 189,225
Time globe, L. P. Juvet..... 189,042
Tire heating apparatus, S. G. Reed (r)..... 7,589
Tobacco pipe, J. Davis..... 189,023
Tool holder, T. Strobridge..... 189,282
Towel rack and wall protector, E. Pullan..... 189,260
Traveling bag, safety, H. Collins..... 189,089
Treadle, W. B. Floyd..... 189,093
Truck, brick yard, E. Remillard..... 189,058
Truck, garbage, J. O. A. Bennett..... 189,015
Trucks, etc., griping attachment, Thomas *et al*..... 189,152
Valve, Mann & Owens..... 189,049
Valve, automatic check, O. Collier..... 189,194
Valve, balance slide, T. M. Nagle..... 189,055
Valve, steam pump, N. W. Wheeler..... 189,290
Vapor burner, F. A. Lyman..... 189,242
Vehicle, side bar spring, J. F. Bridget..... 189,183
Ventilator, G. R. Moore..... 189,054
Ventilator, kitchen, J. A. Leeper..... 189,114
Ventilator, railway car, S. Darling..... 189,022
Vessels, relieving stranded, H. F. Knapp..... 189,233
Wagon brake lock, S. H. Miller..... 189,052
Wagon seat spring, B. F. Wells..... 189,160
Weed destroyer, J. A. Lees..... 189,238
Well tubing anchor, etc., Wanner & Yonkers..... 189,288
Windmill, D. Nysewander..... 189,132
Windmill, E. Stata..... 189,146
Window blind, J. Miller..... 189,125
Window mirror, P. W. Ralfs..... 189,139
Window screen, R. Calhoun..... 189,080
Wool oil for glue, H. Thaulow..... 189,149
Wringer, L. Sternberger..... 189,278

DESIGNS PATENTED.

9,873.—CORSET.—M. Adler, New Haven, Conn.
9,874 to 9,876.—CARPETS.—A. Baye, London, England.
9,877.—DISHES.—E. Boote, New York city.
9,878.—TYPES.—J. M. Conner, Greenville, N. J.
9,879.—STOVES.—R. A. Culter *et al*, Peoria, Ill.
9,880.—CARPETS.—E. Daniel, Paris, France.
9,881.—MOTTO.—J. W. Fleischmann, Williamsburg, N. Y.
9,882.—HINGES.—F. T. Fracker *et al*, New Britain, Conn.
9,883 to 9,886.—NECKLACE.—G. F. Gleason, Newark, N. J.
9,887.—CHAIRS, ETC.—H. F. Goodwin, Sheboygan, Wis.
9,888.—CHAIR FRAME.—A. G. Hofstatter, New York city.
9,889.—OIL CLOTHS.—J. Hutchinson, Newark, N. J.
9,890.—STOVES.—O. B. Keeley, Spring City, Pa.
9,891.—PIPE.—J. F. Starr, Jr., Camden, N. J.

[A copy of any of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

© 1877 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - - $1.00 a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

VALUABLE BOOKS
For Mechanics and Metal Workers.

Amateur Mechanics' Workshop.—A Treatise on Casting, Forging, Brazing, Soldering, and Carpentry. Illustrated, 8vo. $3 00

Blinn.—A Practical Workshop Companion for Tin, Sheet-Iron, and Copperplate Workers. 100 illustrations. 12mo. $2 50

Byrne.—The Practical Metal-Worker's Assistant. 609 engravings. 8vo. $7 00

Byrne.—The Practical Model Calculator. 8vo. . . . $4 50

Byrne.—Handbook for the Artisan, Mechanic, and Engineer. 185 wood engravings. 8vo. $5 00

De Koninck—Dietz.—A Practical Manual of Chemical Analysis and Assaying. Edited, with Notes, by Robt. Mallet. American Edition, with Notes and an Appendix on Iron Ores, by A. A. Fesquet . . . $2 50

Guettier.—Metallic Alloys. By A. A. Fesquet. 12mo. $3 00

Landrin.—A Treatise on Steel. By A. A. Fesquet. 12mo. $3 00

Larkin.—The Practical Brass and Iron Founder's Guide. By James Larkin. 12mo. $2 25

Napier.—Manual of Electro-Metallurgy. By Jas. Napier. 8vo. $2 00

Overman.—The Moulder's and Founder's Pocket Guide. By Fred. Overman. 12mo. $1 50

Overman.—The Manufacture of Steel. A new and enlarged edition. By A. A. Fesquet $1 50

Rose.—The Complete Practical Machinist: embracing Lathe-work, Vise-work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc., etc. By Joshua Rose. Illustrated by 130 engravings. 376 pages. 12mo. $2 50

Roseleur.—Galvanoplastic Manipulations. By A. A. Fesquet. 127 illustrations. 8vo. $6 00

Vaile.—Galvanized Iron Cornice Worker's Manual. By Charles A. Vaile. Illustrated. 4to. . . . $5 00

Warn.—The Sheet-Metal Worker's Instructor and Boiler Maker. By Reuben H. Warn. 32 plates. 37 wood-cuts. 8vo. $3 00

Watson.—The Modern Practice of American Machinists and Engineers. By Egbert P. Watson. 86 wood-cuts. 12mo. $2 50

☞ The above or any of our Books sent by mail, free of postage, at the publication price.

Our new and enlarged **Catalogue of Practical and Scientific Books**—96 pages, 8vo—sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 Walnut Street, Philadelphia.

A NEW UTICA PORTABLE STEAM ENGINE AT A bargain. Engine 6-horse; Boiler 8-horse. Price $625; maker's price $925. Apply to CHARLES MILLAR & SON, Utica, N. Y.

THE DINGEE & CONARD CO'S
BEAUTIFUL EVER-BLOOMING
ROSES

Strong Pot Plants, suitable for immediate flowering, sent safely by mail, postpaid. **5 splendid varieties,** *your choice*, all labeled, for **$1; 12** for **$2; 19** for **$3; 26** for **$4; 35** for **$5.** For 10 cents each additional, one **Magnificent Premium Rose** to every dollar's worth ordered. Send for our **NEW GUIDE TO ROSE CULTURE,** and choose from over **300** finest sorts. We make Roses a **Great Specialty,** *and are the largest Rose-growers in America.* Refer to 100,000 customers in the United States and Canada. THE DINGEE & CONARD CO., ROSE-GROWERS, West Grove, Chester Co., Pa

TO CONTRACTORS AND IRON FOUNDERS.—Tenders are invited by the Board of Water Commissioners of the City of Ottawa, to be sealed and addressed to the undersigned, and indorsed "Tender for Water Pipes," not later than Monday, the 7th day of May, 1877, for the supply of about

19	Tons of	8-inch	Water Pipe,	12	feet long,
457	"	5	"	12	"
50	"	3	"	12	"

according to specifications to be had on application.
JAS. F. CUNNINGHAM,
OTTAWA, 20th April, 1877. *Secty. W. W. Comrs.*

The Farquhar Separator
(Warranted)
Penna. Agricultural Works.
York, Pa.
Lightest draft most durable simplest, most economical and perfect in use. Wastes no grain, cleans it ready for market.
Steam Engines, Horse Power and Threshers of all Kinds. Also, Ploughs, Cultivators, &c., &c.
Send for Illustrated Catalogue.
Address A. B. Farquhar, York, Pa.

PRICE REDUCED.

WEYRAUCH: IRON & STEEL.

Strength and Determination of its *Dimensions* with Reference to Latest Experiments. By Prof. J. J. Weyrauch, of Stuttgart. Translated by Prof. A. Jay DuBois, of Lehigh University, with an appendix by Prof. R. H. Thurston, of Stevens Institute.

1 vol., 8vo, with four folding plates, $1.00.

Published and for sale by

JOHN WILEY & SONS,
15 Astor Place, New York.

Mailed and prepaid on receipt of price.

FRICTION CLUTCHES and ELEVATORS.
VOLNEY W. MASON & CO. PROV. R. I.

$8 FOR COMPLETE SET OF ENGINE CASTING, 2-in. bore, 4-in. stroke. For cut and particulars, address WM. DUSTON, 123 Exchange Place, Philadelphia, Pa.

$2500 a year to Agents. *Outfit and a $25 Shot Gun free.* For terms address, *J. Worth & Co., St. Louis, Mo.*

STRENGTH AND CALCULATIONS OF DIMENSIONS OF IRON AND STEEL CONSTRUCTIONS,
With reference to the latest experiments. Translated from the German of J. J. WEYRAUCH, Ph. D. With FOUR FOLDING PLATES. 12mo, cloth, $1.
D. VAN NOSTRAND,
No. 23 Murray and 27 Warren Sts.
*** Copies sent by mail on receipt of price.

TEMPERED SPRINGS AND ROLLERS. Coiled Tempered 3-inch springs, 25 to 30 feet long. Hardened Steel Rollers, 6-inch by 5 diameter, new, adjustable to any width. Gearing complete. Will be sold very low. Address A. E. PROCTOR, 206 Commercial St., Boston, Mass.

BEST BOLT CUTTERS. New Styles. Low Prices. H. B. BROWN & CO., New Haven, Conn.

A SCIENTIFIC CURIOSITY.
PERPETUAL MOTION ACCOMPLISHED. A beautiful Magnetic Instrument, which has been running since 1865, for sale. CHAS. E. NEWTON, 85 Macdougal St., N. Y.

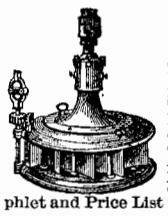
RISDON'S IMPROVED
TURBINE WATER WHEEL
Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

AMATEUR PHOTOGRAPHIC APPARATUS. Latest invention. Everybody can operate with perfect success. Complete with chemicals from $5 to $25. Enclose stamp for circulars. E. SACKMANN & CO., 278 Pearl Street, near Fulton, New York.

WESSELL METAL, A PERFECT IMITATION of gold in color, surface, and acid tests, for manufacturers of imitation jewelry, and other workers in fine yellow metal. Wessel Manuf'g Co., No. 317 E. 22d St., N. Y.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector,** capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J. E. BUERK, P. O. Box 979, Boston, Mass
N. B—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. Proceedings have been commenced against Imhaeuser & Co. for selling, contrary to the order of the Court. Persons using clocks infringing on my patent, will be dealt with according to law.

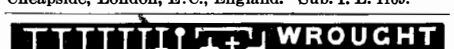
SPECIAL MACHINERY, TOOLS, MODELS, AND Patented Articles made to order by A. A. POOL & CO., 55 R. R. Ave., Market St. Station, Newark, N. J.



THE SUCCESS.
Why is the Success ahead? Because its *great merits* were *attested* by the managers of the late Centennial in causing the first award on Turbines to be given it, and in selecting it as the *Standard Wheel* for *estimating the leakage* of the wheels of the world there represented. *Because it gives over 80 per cent.* of power under PART as well as FULL GATE. Send for descriptive Pamphlet and Price List to S. M. SMITH, York, Pa.

A NEW DEPARTURE. TRAVELING men wanted. STAPLE GOODS. NO PEDDLING Salary $75 a month. Hotel and traveling expenses paid. S. A. GRANT & CO., manufacturers of ENVELOPES and PAPER, 2, 4, 6, and 8 Home St., CINCINNATI, OHIO.

WANTED, BY A FIRST-CLASS HOUSE of Machinery import at Berlin, new machines and articles of technical trade. First references given. Apply to the office of RUDOLF MOSSE, 1 Old Change, Cheapside, London, E. C., England. Sub. 1. L. 1109.



THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).

The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that were owners fully aware of the small difference which now exists between the use of Wood and Iron, that in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

Wood-Working Machinery,
Such as Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

Pocket Coin Detector.
—Size of a silver dollar; it tests size, gauge, and weight, U. S. Mint standard; price 25c. by mail; agents wanted; liberal discounts. J. W. SUTTON, 95 Liberty St., New York.

Patent Adjustable Rubber Bucket
for Chain Pumps, with the buckets ten feet apart on the chain. Will raise a full flow of water from deep wells. It is a lifting and suction pump, works easy, and very durable. State and county Rights for sale. THOMAS KENYON, P. O. Box 103, Hamilton, Ohio.

DANBURY DRILL CHUCKS. Perfected and Price reduced. Manufactured by the HULL & BELDEN CO., Danbury, Conn.

THE BLACK HILLS,
And American Wonderland, by H. N. Maguire, who has spent 12 years in the Hills and Yellowstone region. The latest, fullest, and only truthful accounts of Gold and Silver prospects, Agricultural and Grazing resources, Climate, Hunting and Fishing, the Indians, and Settlers' Adventures and Conflicts with them, Mining and Wild Western Life, and the grand Natural Wonders of this most remarkable country—Waterfalls, Boiling Geysers, noble Scenery, immense Gorges, etc.
Illustrated with **27** Fine Engravings, and a large new Map, corrected to March 1. Price, only **10** cents; by mail, **12** cents. Sold by **all Newsdealers,** or sent postpaid, by
DONNELLEY, LOYD & CO., Pubs., Chicago, Ill.

WANTED MEN to travel and sell to **Dealers** our unbreakable glass chimneys and lamp goods. **NO PEDDLING.** Salary liberal. Hotel and traveling expenses paid. MONITOR LAMP CO., 264 Main St., CINCINNATI, OHIO.

TOOLS for stone cutters, contractors, and masons. I. V. MEAD, Manufacturer, 370 Ave. A near 23d St., N. Y. Pat. Bush Hammers a specialty.

EUREKA SAFETY POWER!

Practically **impossible to explode.** Tested to 300 lbs. pressure per square inch. 2-Horse Power, **$150,** 3 to 4 H. P., **$250.** Also, Stationary Engines and Boilers, and **Spark Arresting Portable Engines** for plantation use. Send for our circular. Discount to the trade.
B. W. PAYNE & SONS,
Corning, N. Y.

WANTED—THE RIGHT TO MANUFACTURE Breech-Loading Single Barrel Rifles. Address LEMAN'S RIFLE WORKS, Lancaster, Pa.

WE ENAMEL
in FINE JET BLACK every variety of turned wood work, parts of machinery, castings, tin ware and other metal work. ENAMELED JET GOODS, in wood or metal, made to order. AMERICAN ENAMEL CO. 17 WARREN ST. PROVIDENCE, R. I.

THE TRUANT BOYS: A more ingenious picture than the Toll-gate. Sent free for stamp. E. C. Abbey, Buffalo, N. Y.

N. F. BURNHAM'S
1874
WATER WHEEL
Is declared the "standard turbine," by **over 600** persons who bought and use them with **part** and **full gate** open. Pamphlets Free.
N. F. BURNHAM, York, Pa.

OTIS' SAFETY HOISTING Machinery.
OTIS BROS. & CO., No. 348 Broadway, New York.

50 Visiting Cards, with name, 10c. and stamp. Ag'ts Outfit 10c. L. C. COE & CO., Bristol, Ct.

BENTEL, MARCEDANT & CO
MANUFACTURERS OF SUPERIOR
UNIVERSAL WOOD WORKERS
TRADE MARK
BAND SAWS, SCROLL SAWS
PLANING & MATCHING MACHINES
UNIVERSAL HAND JOINTERS
MOLDING, DOVETAILING, BORING, FRIEZING, SHAPING & SAND PAPERING MACHINES, PLANER KNIVES & MOLDING BITS
HAMILTON, OHIO.

Revolvers 7-shot $2.50, 70 kinds. Guns & Rifles $5 to $500. Monster ill. Cat. for 3-ct. stamp. WESTERN GUN WORKS, Chicago, Ill.

VANDERBURGH, WELLS & CO., MACHINISTS' Pattern and Brand Letters, etc., Complete Newspaper Outfits, Engravers' Boxwood, etc. 18 Dutch Street, cor. Fulton, New York.

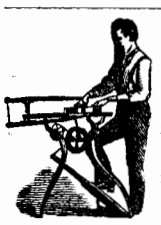
$66 a Week in your own town. Terms and $5 outfit free. H. HALLETT & CO., Portland Maine.

IT PAYS to sell our Rubber Hand Printing Stamps. Terms free. G. A. HARPER & BRO., Cleveland, O.

BRADFORD MILL CO.
Successors to Jas. Bradford & Co.
MANUFACTURERS OF
French Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishing.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, *Pres.* W. B. Dunlap, *Sec.*
☞ PRICE-LISTS SENT ON APPLICATION.

PATENT SCROLL AND BAND SAW MACHINES A speciality. CORDESMAN, EGAN & CO., Cincinnati, O.

$50.00 SCREW-CUTTING **FOOT LATHES**—Foot Drill Presses. Send for Circular to H. L. SHEPARD, Cincinnati, O



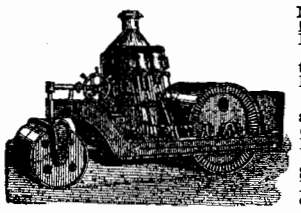
BARNES' FOOT POWER MACHINERY.
13 Different machines with which Builders, Cabinet Makers, Wagon Makers, and Jobbers in miscellaneous work can compete as to QUALITY AND PRICE with steam power manufacturing; also Amateurs' supplies, saw blades, fancy woods and designs. Say where you read this, and send for catalogue and prices.
W. F. & JOHN BARNES,
Rockford, Winnebago Co., Ill.

Pond's Tools
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. **Worcester, Mass.**

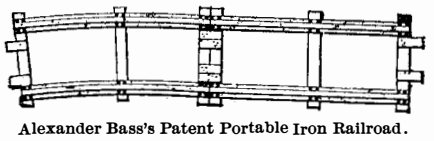
MACHINERY
OF EVERY DESCRIPTION.
The George Place Machinery Agency
121 Chambers & 103 Reade Streets, New York.

THE DRIVEN WELL.
Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
NEW YORK.

PIONEER IRON WORKS,



Nos. 149 to 163 William St., BROOKLYN, N. Y.
Manufacturers of the A. LINDELOF Patent Steam ROAD ROLLER and TRACTION ENGINE. All kinds of Paving Machinery. Machinery for Sugar Houses and Plantations a Specialty.



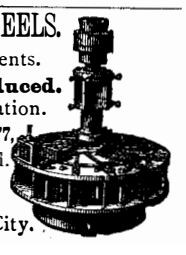
Alexander Bass's Patent Portable Iron Railroad.

MANUFACTURE OF ARTIFICIAL BUTTER.—By Prof. Henry A. Mott, Jr., E.M. With six engravings.—Being a History of the Artificial Butter Manufacture, Descriptions of the Principal Processes now in use, Details of Latest Improvements, Plan of an Artificial Butter Factory, Engravings of the Machinery required, Chemical Analyses of Butter and of Artificial Butter, Details of the Costs of setting up an Artificial Butter Factory, the Capital required, the materials and quantities consumed, Cost of manufacture per pound, the Daily Profit, etc. A complete and reliable treatise contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 48 and 49. Price, 10 cents each. To be had at this office and of all newsdealers.

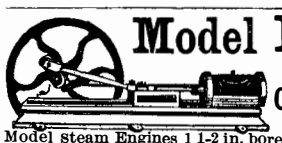
HOME TELEGRAPH INSTRUMENT, Battery, Book of Instruction. Complete and reliable outfit for *Learning Telegraphy,* and operating private Telegraph Lines. Price $5.00. Descriptive circulars mailed free. L. G. TILLOTSON & CO., 8 Dey St., N. Y.

FIRE AND RED BRICK PRESSES. FACTORY, No. 309 S. Fifth St., Phila. S. P. MILLER & SON.

LEFFEL WATER WHEELS.
With recent improvements.
Prices Greatly Reduced.
7000 in successful operation.
FINE NEW PAMPHLET FOR 1877, I
Sent free to those interested.
James Leffel & Co,
Springfield, O.
109 Liberty St., N. Y. City.



STEAM PUMPS.
FIRST PRIZES, CENTENNIAL, PHILA., VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON.
Send for circular of recent patented improvements.
THE NORWALK IRON WORKS CO.,
Prices Reduced. South Norwalk, Conn.



Model Engines.
Complete sets of CASTINGS for making small Model steam Engines 1 1-2 in. bore, 3 in. stroke, price, $4; ditto 2 in. bore, 4 in. stroke, price, $10, same style as cut. Eureka Foot Lathes only 15 Dollars. Gear Wheels and Parts of Models. All kinds of Small Tools and Materials Illustrated Catalogue Free.
GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

CHAMPION
SAFETY
ELEVATORS.
HAS PAT. FRICTION PULLEYS, AN AUTOMATIC STOP, A STRONG IRON FRAME, A SAFETY PLATFORM, AND IS MADE IN A FIRST CLASS MANNER, AT VERY LOW RATES, BY D. FRISBIE & CO., NEW HAVEN, CONN.

Brainard Milling Machines all styles and sizes.
Universal Milling Machines from $200 upwards; Brown's Patent Screw Machines, &c., &c. Address BRAINARD M. M. CO. 131 Milk St., Boston, Mass.

YOU ask WHY we can sell First-Class 7 1-3 Octave Rosewood Pianos for **$290.** Our answer is, that it costs less than **$800** to make any **$600** Piano sold through Agents, all of whom make **100 per ct.** profit. We have no Agents, but sell DIRECT to Families at Factory price, and warrant five years. We send our Pianos everywhere for trial and require no payment unless they are found satisfactory. Send for our Illustrated Circular, which gives full particulars, and contains the names of over 1500 Bankers, Merchants and Families that are using our Pianos in every State of the Union. Please state where you saw this notice. Address,
U. S. PIANO CO., 810 Broadway, N. Y.

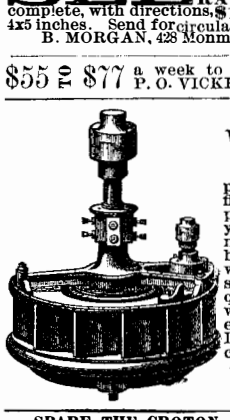
AYER & SON'S MANUAL
For Advertisers
A complete guide to advertisers. *New Haven Journal.*—A necessity to all who advertise. *Louisville Commercial.*—The most complete and reliable work of the kind. *Pittsburg Gazette.*—**Sent free** to all who advertise.
N. W. AYER & SON Advertising Agents, TIMES BUILDING, PHILADELPHIA.
Get our Estimate before making any advertising contracts. Our business is large. Facilities unsurpassed. Prices the lowest. Terms the best.

$12 a day at home. Agents wanted. Outfit and terms free. TRUE & CO., Augusta, Maine.

Lathes, Planers, Shapers, Drills,
Gear & Bolt Cutters, &c. E. GOULD, Newark, N. J.

SEE PHOTOGRAPHIC APPARATUS & CHEMICALS complete, with directions, **$10.** No toy; takes pictures 4x5 inches. Send for circular.
B. MORGAN, 423 Monmouth St., Jersey City, N. J.

$55 TO $77 a week to Agents. $10 *Outfit Free.* P. O. VICKERY, Augusta, Maine.



BELLEFONTE
Water Wheel.
This wheel is offered to the public with the fullest confidence on the part of the proprietors that, after 12 years' experience in the manufacture of leading turbines, they have produced a wheel that, under all circumstances, will fulfill all the requirements of a first-class wheel, combining durability, efficiency, and low price. Information given on application to
WM. P. DUNCAN & CO.,
Bellefonte, Pa.

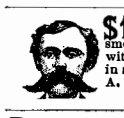
SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y. who control the patent for Green's American Driven Well

$984 Made by one Agent in 57 days. 13 new articles. Samples free. Address, **C. M. LININGTON, Chicago.**

$5 TO $10 A DAY TO AGENTS. SAMPLES FREE. 32 page catalogue. L. FLETCHER, 11 Dey St., N. Y.

$5 Outfit free. Salary guaranteed. Write at once to EMPIRE NOVELTY CO., 309 Broadway, New York.

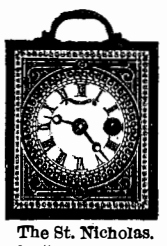
$3 WATCHES. Cheapest in the known world *Sample watch and outfit free to Agents.* For terms address COULTER & CO. Chicago



$100.00 REWARD. This MOUSTACHE or HEAVY BEARD produced on a smooth face by the use of **DYKES BEARD ELIXIR,** without injury, or will forfeit $100.00. Price by mail in sealed package 25 cents, 3 packages only 50 cents. A. L. SMITH & Co., Palatine, Ill., Sole Agents.
☞ We caution the public against imitations.

Brown & Sharpe M'f'g Co.,
PROVIDENCE, R. I.,
Have ready for delivery Universal and Plain Milling Machines, two sizes of each; Revolving Head Screw Machines of three sizes; Screw Finishing and Slotting Machines; Grinding Machines of three kinds; Grindstone Truing Devices and Patent Cutters for the Teeth of Gear Wheels, which can be sharpened by grinding without changing their form. Index plates on hand, and made or drilled to order. *Our new Illustrated Catalogue mailed on application.*

S. B. JEROME & CO.,
Extra Quality Clocks.
New Haven, Conn.
(Established 1856).



Manufacture various special, novel, and tasteful styles of
Detached Lever Time Pieces.
They have substantial and durable metal movements, with balance wheel like a watch; will run in any position, and are of especial value to the traveler.
They are suitable for the Library, the Family Room, the Dining Room, the Sleeping Room, the Shop, the Store, and the Cabin, and any place where correct time is desirable.

The St. Nicholas.

The "St. Nicholas," imitation morocco, (4½x4) $2.00
The "Souvenir," Turkey morocco, (4½x4) 2.50
The "Cabinet," black walnut, (6x4½) 2.50
The "Boudoir," octagon, morocco, (5 in.) 3.50
The "Roslyn," Scotch plaid, (6x4½) 4.00
The "Melrose," Scotch plaid, (6x4½), mantel, 4.00
The "Holyrood," polished white holly, (6x4½), " 4.00
Accuracy and Durability Guaranteed.
Carefully packed and sent safely by mail, post-paid, on receipt of price.

© 1877 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

GUARDIOLA'S
COFFEE & SUGAR MACHINERY

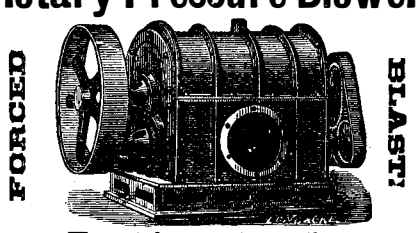
Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine. Coffee-Hulling and Polishing Machines. Coffee-Washing Machine. Helix Sugar Evaporator.

Messrs. C. ADOLPHE LOW & CO., 42 Cedar Street, Messrs. MUNOZ & ESPRIELLA, 52 Pine Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.

Best Tempered Cast Steel.
Retail Price, 9 Cents per lb.
WARRANTED. ☞ Send for Circular.
Fisher & Norris, Trenton, N. J.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

BAKER'S
Rotary Pressure Blower



Warranted superior to any other.
WILBRAHAM BROS.
No. 2318 Frankford Avenue, Philadelphia.

[ESTABLISHED 1846.]

Munn & Co.'s Patent Offices.

The Oldest Agency for soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the Government fees, and watch each case, step by step, while pending before the examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business, both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1638 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

NOYE'S
MILL FURNISHING WORKS
are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

ESTABLISHED 1844.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine, I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

JOS. G. ROGERS & CO., MADISON, IND., wish to place a consignment of their Tannate of Soda BOILER SCALE PREVENTIVE in all important towns in the United States, to be sold on commission. Applications solicited. Send for book on Boiler Incrustation.

NON-COMBUSTIBLE STEAM BOILER AND PIPE
COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO., Foot E. 9th St. N. Y.; 1202 N. 2d St., St. Louis, Mo.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

$5 to $20 per day at home. Samples worth $5 free. STINSON & Co., Portland, Me.

STEAM PUMPS Wright's Pat. Bucket Plungers are the best. VALLEY MACHINE CO. Easthampton, Mass.

PERFECT
NEWSPAPER FILE

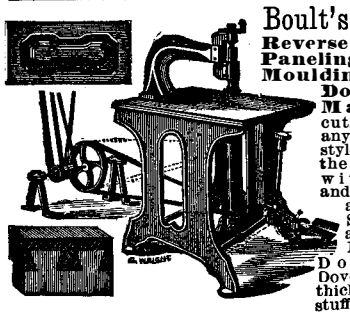
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

MACHINERY OF IMPROVED STYLES FOR making SHINGLES, HEADING and STAVES; also GUAGE LATHES for TURNING HANDLES. Sole makers of Law's Pat. Shingle and Heading Sawing Machine. Address TREVOR & CO., Lockport, N. Y.

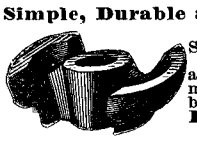
THE BEST
AND MOST ECONOMICAL
Boiler Feeder
IS
FRIEDMANN'S INJECTOR,
MANUFACTURED BY
NATHAN & DREYFUS, New York.
108 Liberty St.

Send for Circular.



Boult's Patent
Reverse Motion Paneling, Variety Moulding and Dovetailing Machine, cuts Panels of any design or style of mould in the solid wood with neatness and dispatch. Is a first class Shaper, Edge and Scroll Moulder. Does general Dovetailing with thick or thin stuffs.

Simple, Durable and Efficient.



☞ Send for Pamphlet and Sample of work.
Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the
B. C. MACHINERY CO.
BATTLE CREEK, MICH.

P. BLAISDELL & CO.,
Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinists' Tools.

S. GUITERMAN, EXPORT AND COMmission Merchant, No. 4a Lawrence lane, Cheapside, London. New York office, Guiterman Brothers, 454 Broadway. Best of attention to introduce Merchandise, Patents, etc., in any part of Europe

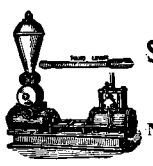
---

Local and Traveling Agents Wanted in every State and Territory in the Union, to sell Mechanical Goods. Liberal commission offered. Prompt replies desired, and full details. Address "MORGAN," Box 2874, N. Y.

Blake's Patent Stone & Ore Crusher.

NEW PATTERNS, with important improvements, and abundant strength. This is the only machine used by the principal MUNICIPAL, RAILROAD and MINING CORPORATIONS and CONTRACTORS in the United States and foreign countries, for breaking hard and brittle substances TO ANY SIZE. Send for circular. Address,
BLAKE CRUSHER CO., New Haven, Ct.

UPRIGHT DRILL PRESSES.
H. BICKFORD, Cincinnati, O.



Niagara Steam Pump Works.
ESTABLISHED 1826.
CHARLES B. HARDICK,
No. 23 Adams Street, BROOKLYN, N. Y.

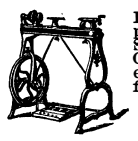
KNOWLES'
STEAM PUMP WORKS,
92 & 94 Liberty St., New York.
Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

ROCK DRILLING MACHINES AND AIR COMPRESSORS.
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

Type and Printing Materials FOR SALE.

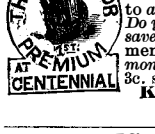
The following Fonts of Type, in good condition, having been but little used:
Brevier, on Long Primer Body, about 550 lbs.
Brevier, 100 lbs.
Nonpareil on Brevier Body, 360 lbs.
Agate, 250 lbs.
Sixteen Cases Job Type, in Cabinet.
All the above are Copper-faced.
Leads, Brass Rules, etc.
Cases, 44 pairs.
Column Galleys, brass bottomed, 6.
Chases, wrought iron, 2 pairs, 36x24 inches.
Composing Frames, 4.
Racks, 2.
Imposing Stones, one 75x30 inches, one 72x30, both on stands with drawers.
Roller Press.
The above were used on the SCIENTIFIC AMERICAN, and are in clean and perfect condition. The room in which the above is deposited is wanted for other purposes on the first of May, and the lot will be sold very cheap. Apply at the office SCIENTIFIC AMERICAN, 37 Park Row, N. Y., for further particulars.

EAGLE FOOT LATHES,



Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.
WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

FOR SALE, TO CLOSE THE CONCERN.
Entire contents of Machine Shop, entrance 530 Water St., New York, consisting of 30 h. Steam Boiler, now in good running order, 12 h. p. Steam Engine, Cameron Steam Pump, Planing Machine, Engine Lathes, Milling Machines, Screw Cutters, Ordinary Lathes, Shears, Presses, Small Blower, Forge, Vises, Variety of Small Tools, Shafting, Pulleys, Belting, Benches, Patterns, etc.
Will be sold in lots to suit purchasers, at very low prices. Apply immediately to E. D. BARLOW, Assignee, as above. Lease of premises—50x200 ft.—for sale.



$3 PRINTING PRESS!
Prints cards, envelopes, etc., equal to *any* press. Larger sizes for large work. *Do your own printing and advertising and save money.* Excellent spare hour amusement for old or young. Or it can be made *money making* business anywhere. Send 3c. stamps for large catalogue to
KELSEY & CO., Manufacturers,
Meriden, Conn.

PUNCHING PRESSES. Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

1872, 1873, 1874, 1875, 1876,
SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876, will find them recorded in the five volumes of the SCIENCE RECORD, now offered at half the original price.

Every Department of Science is treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:
CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND,
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
BIOGRAPHY AND NECROLOGY.

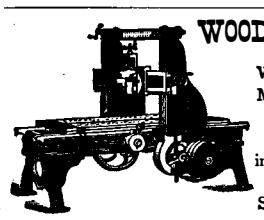
Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of $1.25 each, or $5 for the set of five volumes.

They were published and heretofore sold at $2.50 each, or $10 for the set.

State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remembering that the date of the volume covers the events and discoveries of the previous year. Sent by mail on receipt of price. Address
MUNN & CO., PUBLISHERS.
37 Park Row, New York city.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3rd Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by
FULLER, DANA, & FITZ, Boston, Mass.
GEO. PLACE & CO. 121 Chambers St., N. Y.



WOOD & LIGHT Machine Co.
WORCESTER, MASS.
Manufacture all kinds of
Iron-Working Machinery,
including many novelties.
Shafting, Pulleys, &c.
Send for Circulars.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

BUY YOUR BOILER AND PIPE
COVERING
direct from the Manufacturers.
ASBESTOS FELTING CO.,
Front St., near Gouverneur, N. Y.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, New York.

A. S. CAMERON'S
PATENT
"SPECIAL" Steam Pump
Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.

Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	$ 50	3½ in.	2 in.	4
1	75	4	2	6
2	100	5	2½	6
3	150	6	3	7
4	200	7	3½	7
5	275	7	4½	10
6	325	8	4	10
7	400	10	5	12
8	425	10	6	12
9	480	12	7	12
10	550	14	9	15
11	700	16	10½	15
12	850	18	12	18

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States,
A. S. CAMERON,
Works, Foot of East 23d St.
NEW YORK CITY.

The HOADLEY
PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST & MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE. MASS.
STATE WHERE YOU SAW THIS.

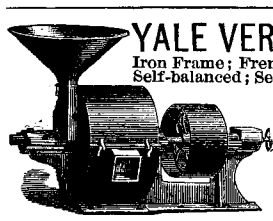
The New $20 Microscope
is fully equal to any that could have been bought three years ago for $50. Send for descriptive circular.
For the best book of practical instruction get "How to Use the Microscope," by John Phin. 75 cts. by mail.
INDUSTRIAL PUBLICATION CO., 176 Broadway, N. Y.

FOOT POWER TENONING MACHINES FOR SALE By S. C. HILLS, 78 Chambers St., New York.

"IN ALL THINGS, BUT PROVERBIALLY IN MECHANISM, THE SUPREME EXCELLENCE IS SIMPLICITY."—*Jas. Watt.*

The Old Reliable Heald & Sisco Pump
Carries off the honors at the CENTENNIAL. The award of the Judges is based on its "SIMPLICITY, compactness, and perfection of WORKMANSHIP."

No higher praise could be given, but no award whatever was necessary to strengthen the confidence of thousands already using them. Whenever subjected to severe practical tests, they have always proved their superiority over other centrifugal pumps, and always will, as it is absolutely impossible to devise a pump which can excel it for simplicity, tremendous capacity, and cheapness. Capacity of Pumps from one hundred gallons to thirty-five thousand gallons per minute. For Paper Makers, Tanners, Contractors; for irrigation, or for any purpose where a large quantity of water or other fluid is to be raised, the Heald & Sisco Pump stands without a rival. More than three hundred paper makers use them. More than three hundred tanners use them. They are used in every State of the Union, and in nearly every country in the world. Pumps alone, and Pumps and Engines combined, adapted to nearly every kind of work, on hand and built at short notice.
First premiums awarded at New Orleans in 1871, in Cincinnati in 1872, and an award for Special Merit at the American Institute in 1872. Send for illustrated pamphlet of 78 pages, with 18 pages of certificates and references. Address
HEALD, SISCO & CO., Baldwinsville, N. Y.



YALE VERTICAL MILL.
Iron Frame; French Burrs; Self-oiling; Self-balanced; Self-feeding; Long Bearings. Best, Simplest, *Cheapest*, and for quality and quantity ground no superior.
YALE IRON WORKS
NEW HAVEN, CONN.

DEAFNESS RELIEVED. No medicine. Book free. G. J. WOOD, Madison, Ind.

ARSENIC IN THE ARTS.—A Lecture before the Medical Association of Central New York. By S. A. Lattimore, LL.D., Professor of Chemistry in the Rochester University. A popular and important paper. SCIENTIFIC AMERICAN SUPPLEMENT No. 29. Price, 10 cents. To be had at this office and of all newsdealers.

PATENTEES or makers of useful and saleable articles should send me samples. I advertise direct to 25,000 Agents and Dealers. Articles retailing for 25 cents or less preferred. DAVID C. COOK, 46 Madison St., Chicago, Ills.

FOR SALE.—THE GOOD WILL, MACHINERY, etc., of a large Iron Works, consisting of Machine Shop, Foundries, etc., having a good trade in a paying specialty. Present parties wish to retire from business. The buildings will be leased for a long term of years. For further particulars, address A. A. FREEMAN, 430 Walnut Street, Philadelphia, Pa.

GLASS OILERS. Best in use. Send for circular. CODY & RUTHVEN, Cincinnati.

BIG PAY to sell our RUBBER PRINTING STAMPS. Terms free. TAYLOR & Co., Cleveland, O.

Incombustible Mineral Wool
The best and cheapest insulator of heat or cold. Send for circulars, 26½ Broadway, New York.
ALEXANDER D. ELBERS,
P. O. Box 4461. Agent for the Patentee.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

© 1877 SCIENTIFIC AMERICAN, INC.